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ELECTRICAL EXPORTS.

The figures of electrical export trade for April show a good deal of improvement over those for the corresponding month of 1909. The total of electrical apparatus and heavy machinery is no less than $1,443,244, as compared with $979,509. This gain is, however, due wholly to the large shipments of smaller goods; as there was in fact a decline of about $5,000 in heavy machinery, whereas the jump in apparatus and instruments was from $490,483 to $959,186, an increase of 100 per cent. Such gains are very welcome, and would appear to be well sustained even if not at this extreme rate. Dynamos and motors may not be in such brisk demand, but there is some consolation in the continued purchases of the miscellaneous goods, for which, as usual, British North America looms up as a good customer. In its case, the increase was from $132,892 to $227,289. Mexico shows up even better, with an increase from $50,053 to $128,197. Brazil makes a more striking exhibit than that, the figures being $80,263 and $226,040. The United Kingdom did not take much, but it was on the basis of an increase from $36,440 to $76,764.

In all these items there is encouragement, as to better times, as to an expansion of the market, and as to the number and variety of supplies furnished to it. As we develop in the conditions of a manufacturing people, our products tend to become more diversified, with greater prospect of balancing loss on one item of export by gains elsewhere. All this, however, means a closer study of the markets of the world, and fuller knowledge than is yet possessed.

CARING FOR CONVENTIONS.

The registered attendance at the recent National Electric Light convention at St. Louis was no less than 2682, from which it is evident that over 2700 people participated. This is a large number of people to take care of, and outran any previous registration by more than 600, as Atlantic City in 1909 had 2036. Growing rapidly as the association is, it is evident that an attendance of over 3000 is in sight, unless there should be some radical modification in the work and plans of the body, emphasizing more the importance of the meetings of the geographic sections. That situation has not yet developed, however; and it is therefore the obvious duty of the officers to take serious thought as to the arrangements for 1911, even at this early date, and even without the assumption that next year there may be another 30 or 35 per cent gain in the attendance.

The convention at St. Louis was certainly a brilliant success, but careful reflection brings us to the conclusion that the meetings suffered from the magnitude and proximity of the exhibits. The latter were very fine and were artistically displayed, but there was little in which any central-station man could find novelty; and, after all, the papers and discusssions are the main thing of such a convention. With so many hundreds of managers and engineers present, and with some 60 or 70 papers and discussions in three or four sections, it stands to reason that hereafter the meeting rooms, and not the exhibit hall, must be the main, and in fact, the only consideration.

Just as the size of the attendance now limits the association in its choice of a convention city, so this other serious fact must determine where the meetings are to be held. Converted parlors and hastily constructed halls will no longer suffice for work represented by the some 1600 pages of reports and papers printed in advance for St. Louis, and worthy of very full discussion. A place like the Engineering Societies' Building in New York is ideal; and in the development of co-operative work among engineering societies in other cities, like Boston and Chicago, a provision for conventions may well be given a prominent place in the scheme of "getting together." The problem is a very real one when conventions run to the proportions assumed by those of the National Electric Light Association, which is now getting down to its real work in life.

GROUNDING THE SECONDARY.

We are glad to note that the N. E. L. A. committee on grounding the secondary, in its report submitted at St. Louis, withdrew its previous recommendation prohibiting the grounding of secondaries having a voltage in excess of 150 volts. While the report states that the views of the members of the committee as to prohibition of grounding above 150 volts have not changed, they are willing to concede that the danger from grounded secondaries when the voltage exceeds 150 may under certain conditions be minimized, and to leave to individual companies the decision as to whether they shall ground secondaries of voltages higher than 150. A canvass of central stations made by the committee showed that 26 companies now ground 220-volt circuits, while 8 carry the upper limit beyond 300 volts. In addition, some polyphase circuits are so grounded as to have a voltage of 220 or 440 between line and earth. The majority of the companies reporting that ground secondaries expressed the opinion that the danger from the possible breakdown of transformers, and from crosses between high-potential lines and secondaries, is greater than the constant menace of shock from 250-volt or 300-volt grounded secondaries. There was a wide variation of opinion as to what should be the limiting voltage for grounding, but the majority of those answering the circular letter sent out favored setting this limit between 220 volts and 330 volts.

The committee urged the adoption of its proposed rule making it mandatory to ground all circuits of voltages of 150 volts or below, and it is sincerely to be hoped that the association will take some decisive action to give effect to this recommendation, so far as its authority in the premises may extend. While we should like to see the limiting voltage raised to accord with the recommendation of the American Institute of Electrical Engineers—namely, 250 volts—the lower limit covers probably 90 per cent of central-station circuits, and its inclusive adoption would thus vastly decrease the present hazard to life inseparably incident to ungrounded secondaries. Were the association to take a strong stand in the matter, it is probable that the underwriters would feel justified in introducing the requirement in the National Electrical Code, particularly in view of the growing opinion among insurance men that grounding of the secondary also lessens the fire hazard. As to methods of making grounds, the committee naturally favors connection to water-piping systems, with driven pipes as second choice. It is stated that while the ground plate properly installed and under favorable conditions gives excellent results, tests show that as ordinarily installed the ground is not permanent, and that the resistance may vary considerably with the season; moreover, the requirement that the plate shall be buried below the level of permanent moisture is one often impossible to meet. The committee believes that when a sufficient number of pipes are used and are driven to a proper depth, they furnish a better method of earthing than the ground plate.

TOUGH TUNGSTEN LAMPS.

It is probable that the National Electric Light convention just ended will go into history as marking the commercial introduction of tungsten filaments which will stand a reasonably hard usage. We have recently reported the discovery of a process for making ductile tungsten filaments of great strength, and Mr. C. F. Scott in presenting a paper at St. Louis, made a very striking demonstration of the manner in which a new type of tungsten lamp may be subjected to violent treatment without injury to the filaments. The strength of the lamp described and shown by Mr. Scott was entirely due to a flexible mounting made possible by the fact that the filament consists of one continuous wire, instead of a number of short lengths fused solidly at each end to a rigid support, as in the case of present tungsten lamps. Taken altogether, it appears that the tungsten lamp, which has already come into general use for the lighting of stores and other large spaces, will soon find equally extensive use in general residence lighting and other service where its fragility heretofore has prevented its adoption. A considerable amount of residence lighting is already being done with tungsten lamps in the sockets that are most used, such as those in living rooms, dining rooms and kitchens; and very soon the only condition limiting exclusive use will be that of first cost.

SMALL COMPANIES AND UNIFORM ACCOUNTS.

At the accounting sessions of the St. Louis meeting of the National Electric Light Association an especial effort was made through papers and discussions to interest the representatives of small companies in the proceedings. This developing policy will be followed in the future, and it should prove a successful means of increasing the attendance at the meetings and of promoting the progress of uniform accounting methods. In order to arouse the interest of officials of small companies in the scheme of accounts which has the official sanction of the association, the accounting committee has prepared a simple system which is adapted to the needs of properties whose revenues do not warrant an elaborate classification. To go a step further and try to persuade the officials of companies that it is to their advantage to adopt the association system will be the chief work of the committee during the coming year. While the wisdom of the general adoption of a uniform system of accounts is therefore well recognized by the committee, it will be understood by all who have followed similar endeavors in other industries that the task thus outlined is a difficult one. If complete uniformity in accounts is ever to be attained, all differences of opinion, whether petty or vital, will require elimination or reconciliation. Present diversities of practice will have to be abandoned. If the large companies show that they use the uniform accounts of the association, the arguments will be

strengthened when the advocates of uniform accounts present their claims to the small properties. The various groups of properties that are controlled through holding companies directly, or are held under a common management which owns sufficient stock to retain control, reach so many sections of the country and are so influential that their adoption of a uniform classification will constitute an argument which the committee can use with strong effect. Lastly, the supporters of the campaign should take into account the increase in the number and power of State commissions with authority to prescribe accounting systems. The companies and the commissions should be able, if they make an earnest effort, to agree on a classification that will give proper publicity to the accounts and fully protect the rights of all concerned.

SUBURBAN NEW YORK ELECTRIC TRACTION OPPORTUNITY.

The concerted increase of commutation rates on railroads entering New York City has again led to statements by various railroad officials that New York City suburban passenger transportation service is conducted at a loss. Whenever improvements in service are demanded, or when rates are to be boosted, the commuter is reminded in no uncertain terms of the philanthropic basis on which his transportation to and from business is conducted by railroads. In the interest both of the self-respecting commuter who wishes to pay his own way through the world, and of the railroads burdened with an unprofitable business, it is to be hoped that some amelioration may be found for a situation as unsatisfactory to the public as it is economically unsound. A solution would appear to lie in diverting suburban passenger traffic, so far as possible, from large railroads to electric-traction systems organized for the sole purpose of handling such traffic. In view of the loss said to be entailed on the large railroads by their suburban business, and the extremely satisfactory manner in which this class of traffic could be handled by transportation companies having lines equipped and conducted for that purpose alone, the Public Service Commissions of New York and New Jersey would doubtless be generous in the terms of grants of the necessary franchises; and the success of the McAdoo independent system of tunnels indicates that proper terminal facilities would not be an impossibility. Moreover, the coming great extensions of the New York City subway system could readily be adapted in detail to such a plan. The situation, in fact, appears ripe for a man, or group of men, with the necessary organizing ability and command of capital, to come forward and modernize the present suburban New York passenger transportation system and methods. The present system is one merely grafted on a general railroad system, with special care to avoid conflict with the exigencies of long-haul traffice rather than to meet frankly and fully the needs of suburban transportation. The methods similarly fall far short of those that could be applied to a local electric traction service unhampered in its conduct by the ideas and prejudices of men trained in the steam railroad field. Electric lines radiating in every direction from river tube terminals or outlying parts of city subways would appear to offer not only a very satisfactory solution to the suburban transportation problem, which is becoming more difficult every year, but have the further advantage of spreading home-building over the entire suburban area and checking its concentration near trunk railroad lines, as occurs at present.

REPORT OF N. E. L. A. COMMITTEE ON TERMINOLOGY.

The committee on terminology, appointed by the National Electric Light Association, reported at the recent St. Louis convention a list of 75 defined terms, which list has been printed in pamphlet form. Such definitions should be of great service to central-station men, because the terms to which they apply occur scattered throughout central-station literature, and their meanings are often misunderstood, or taken in vain. There are few matters harder for a competent committee to agree upon than a set of technical definitions. A group of men assemble, as a committee, to agree on certain technical definitions. Such a committee usually and preferably enlists men of different minds, habits and experiences, but presumably all qualified to discuss the terms under consideration. Some of the men may be literary purists, to whom a bibliographic solecism, or an error in syntax, may be a heinous mental crime; while others are soul-free from such misgivings. Again, some may be terse and laconic in their thoughts and expressions, to whom long-windedness is the unforgivable sin; while others are liberal and profuse in their literary style. Again, some may be scientific precisians, who pride themselves upon accuracy of thought and word, contemning all looseness and irregularity in applied science as footprints of the cloven hoof; while others are solely minded only to convey a homely phrase and a rough idea to the unlettered. Finally, some whose associations and experiences may have been more technical inevitably regard their definitions as submitted to a critical jury of peers in a glaring searchlight of literary and scientific examination; while others, whose experiences have been cast among the ignorant and happy, consider that the suggestions of the committee are to be laid at the bottom of the technical ladder, in the kindergarten stage of phrase formation. All of the above philosophies are good, and each in its own way is justifiable; but when the terms to be defined are proposed, is it any wonder that there should be disputation? The only wonder is that any general conclusion is finally reached.

Out of the 75 terms proposed by the committee in this case, there are some 20 that we would like to see amended or modified in language, although only two or three seem to be inaccurate or misleading. It is quite to be expected, however, that the list, if amended to suit our own views, would fail to satisfy other examiners. Nevertheless, the advantage of producing the other 55 good definitions is so great that the possible disadvantages pertaining to the minority are far outweighed. We understand that a number of these definitions have also been considered by the standards committee of the American Institute of Electrical Engineers, and that some are to be incorporated in the next edition of the Standardization Rules. We hope that the National Electric Light Association will not adopt this list, officially, until there may have been time to compare definitions with those of the A. I. E. E. It does not seem to be either necessary or expedient that all of the definitions adopted by the N. E. L. A. should also be adopted by the A. I. E. E., or reciprocally; but it is of considerable importance that there should be no disagreement between the definitions of the two bodies. It would also be advantageous, although not essential, that the definitions of the same terms by these two bodies should be identical. Since two of the members of the N. E. L. A. committee on terminology are also members of the A. I. E. E. committee on standards, there should be little difficulty in bringing this adjustment about.

Central-Station Census Report.

The second Census Bureau report is now in press and will soon be issued for general distribution. In Director Durand's letter of transmittal to Secretary Nagel, of the Department of Commerce and Labor, it is stated that the statistics were collected under the supervision of Mr. Wm. M. Steuart, chief statistician for manufactures in the Census Bureau, and Mr. T. Commerford Martin, of New York, is credited with the authorship of the section dealing with the technical features of the industry. The analytical tables and textual verifications were made by Mr. Frank L. Sanford.

The census relates to the calendar year 1907 and is the second census of central stations taken since the Census Bureau was made a permanent office. The first covered the calendar year ending Dec. 31, 1902. In order to preserve the comparability of the data the same form of schedule was used to collect the statistics of both censuses and the same form of presenting the data has been followed in both reports. The report is in eight chapters and to these are added general tables, appendices, maps, diagrams and illustrations.

The first chapter is a general discussion. The second gives a summary of the statistics. The third relates to power equipment. The fourth covers line equipment. The fifth is devoted to capitalization. The sixth gives the cost of construction and equipment. The seventh deals with income and expenses. The eighth embraces the technical aspect of the period.

In the first chapter of the report, which is a general discussion of the subject, it is stated that the tendency to sell electricity for general commercial use is constantly increasing among electric-railway companies. In 1902 there were 251 railway companies which furnished electricity for light, power and other purposes. In 1907 this class had grown in number to 330. As to isolated electric plants, if estimated on the basis of growth as of central stations, the number in 1907 was 65,000.

There are 148 tables, of which 32 are general in character. There are 9 tables of the latter relating to commercial and municipal central electric stations; 10 to commercial central electric stations; 10 to municipal central electric stations; and 3 to central electric light and power stations operated by street-railway companies.

The first of all these general tables is a comparative summary of commercial and municipal central electric stations, by States and Territories, for 1907 and 1902. The other eight tables on this subject show, by States and Territories, for 1907, primary power and generating equipment; substation equipment, motors, transformers, meters, customers, and output of stations; analysis of service; analysis of income; analysis of supplies, materials, and fuel; number of salaried employes and total salaries; average number of wage-earners and total wages; and analysis of miscellaneous expenses. Nearly similar data are contained in the next 20 tables relative to commercial central stations and municipal central electric stations.

The last three of the 32 general tables give an analysis of arc-lighting service furnished by plants operated in connection with electric railways for 1907 and 1902; an analysis of incandescent and other varieties of lighting service, as well as motor service and number of meters, by States, 1907 and 1902; and income, by States, 1907 and 1902.

The maps are three in number and the first show the geographic divisions, and the second and third, central-station gross income, 1907 and 1902.

There are seven diagrams, the first relating to central stations and electric railways, by character of primary power, 1907 and 1902. The second refers to central stations, by character of primary power, 1907 and 1902. The other five relate to central electric stations and separately refer to primary power, by States, arranged in the order of their relative importance, 1907 and 1902; steam and water-power, by States, arranged in the order of their relative importance, 1907; capacity of dynamos, 1907 and 1902; capacity of dynamos, by States, arranged in the order of their relative importance, 1907 and 1902; and output, by geographic divisions, 1907 and 1902.

There are 25 artistically executed illustrations, mostly half-tone, scattered throughout the report. It is expected the report will be ready for general distribution in about a month.

Blau Gas.

A plant for the manufacture of Blau gas, or liquefied gas, has been completed at Long Island City, New York, by the Blau Gas Company of America. Mr. E. C. Benedict, the banker, is president of the company, and among its directors are Messrs. E. H. Gary, Theodore N. Vail and Theodore P. Shonts. The liquefied gas is sold in steel bottles 8 in. in diameter and 4 ft. high, each containing 20 lb. of gas. The price has been fixed at 10 cents per pound, or $2 per bottle. It is stated that 1 lb. of gas will supply a 60-cp mantle light for 17 hours. On the basis of 3 cu. ft. per hour of ordinary illuminating gas for a 60-cp mantle lamp, a bottle is thus equivalent to about 1000 cu. ft. of such gas. Assuming the actual candlepower of a 3-cu.-ft. mantle to be equal to that of a 40-watt tungsten lamp, the equivalent cost of electrical energy is 680 watt-hours for 10 cents, or 14.7 cents per kw-hour. For a 3.1-watt per cp. carbon lamp, the competitive figure becomes 5.9 cents per kw-hour. The new gas can thus scarcely be considered a competitor of the electric light. The equipment for using the gas consists of a small steel closet installed against the side of a house, holding two bottles of gas and an expansion cylinder to which the house service is connected.

Proposed Merger of "L" Roads in Chicago.

For some time the advantages of merging the four elevated-railway companies in Chicago have been appreciated, and negotiations looking to that end have been undertaken on various occasions and by different persons. At present the indications are that the consolidated plan advocated by Mr. Henry A. Blair, one of the receivers for the Chicago Railways Company, and also chairman of the board of directors of that company, will be carried out. It is believed that the syndicate which Mr. Blair represents, and in which the National City Bank of New York is interested, has secured options on the South Side Elevated Railroad Company, the Northwestern Elevated Railroad Company and the Chicago and Oak Park Elevated Railroad Company. The Northwestern "L" carries with it the Union Loop Elevated Railroad, since it owns that property. The directors of the Metropolitan West Side Elevated Railroad Company, the remaining company, are in negotiation with Mr. Blair and his friends, and it is believed that a decision will be reached soon.

The proposition is described as a clean cash offer to the stockholders at a price about the market value of the stock. The bonds of the companies will remain undisturbed. The capital stock of all the companies, both common and preferred, represents a total of about $45,000,000, and if the stockholders elect to be paid in cash, the amount turned over to them will be about $23,000,000. It is said that the price offered for the South Side stock is about $70 a share, while for the Northwestern the figure mentioned is $70 a share for the preferred and about $30 for the common. The Chicago and Oak Park is controlled by the Northwestern Company, and if the deal goes through, the stockholders of that company will probably be taken care of by the Northwestern people. It is promised that the plan shall be carried out without any big promotion profits, and without any "water." The plan will become operative if owners of two-thirds of the capital of the several companies agree to the proposition and deposit their stock.

Convention of National Electrical Contractors Association.

The annual convention of the National Electrical Contractors' Association will be held at Atlantic City July 20-22. The sessions will be held in "The Chapel" at the ocean end of Young's Pier, and the headquarters and registration bureau will be at Young's Hotel, opposite the Steel Pier. On account

of important business matters to come before the convention and also owing to the place of meeting, the largest and most interesting convention in the history of the organization is anticipated.

At the opening sessions there will be speakers upon subjects of interest to the electrical trade, the names of whom will be announced later. The business sessions, of course, are open only to members of the association. Among the social features are a smoker for guests and members at the New Berkely Hotel on July 20; a dinner for ladies at Young's Hotel on July 21; an all-day outing at the Inlet for everyone on July 22, with a ball game and other features in the afternoon, a shore dinner at 4 p. m. and a band concert all afternoon. There will also be a roller-chair ride for ladies and guests on July 20 and a trolley ride to Ocean City on the afternoon of July 21. The roller-chair ride for the ladies and non-members will be quite a novelty, taking in the entire Boardwalk and all the places of interest. Bathing suits will be provided each person on one day of the convention, which will enable all in attendance to go in bathing at the same time.

Ohio Long-Distance Telephone Rates Advanced.

A new schedule of long-distance telephone rates for Ohio and points near the borders of that State has been announced by the Central Union Telephone Company and the American Telephone & Telegraph Company. About a year ago rates were almost cut in two to many points in that State in competition with the United States Telephone Company and they have since been allowed to remain at the reduced figures. The advance shown in the schedule is more in the nature of a restoration of the original rates than anything else. In some cases the charges are a few cents higher and in some a little lower than before the cut was made, but it is said that the average will be about the same. Considerable complaint has been caused by the change.

Cleveland-Pittsburgh, Cleveland-Columbus, Cleveland-Toledo, Columbus-Springfield, Columbus-Pittsburgh and some other points along the Ohio River will feel the effect of the restoration more than other places. The rate between Cleveland and Columbus is 5 cents higher than the original schedule and some other like advances are shown, but in the main there is not much difference. The United States Telephone Company did not follow with a general cut, but made reductions to some points. These were restored some months since, or directly after the Morgan interests gained control.

In some quarters it is believed that the United States Telephone Company will establish its new rates upon about the same basis as is used by the Bell companies, three-fifths of a cent a mile. Formerly the Independent rates were fixed at two-thirds of a cent a mile. By some it is intimated that the special committee appointed by the Ohio Independent Telephone Association, at its annual meeting, to act in conjunction with President Frank E. Davis in arranging a schedule of rates, has held up its report pending the announcement of the Bell companies, after it was learned that new rates would be promulgated. It is further believed that the Independent rates will be about the same as the Bell rates when they are announced.

At first thought it would seem that the Bell companies would lose out on the commercial telegraph business it secured through a reduction in rates, but since the relations between these companies and the Western Union Telegraph Company are so close, any loss in telephone business will probably be made up by a gain in telegraph business.

Opponents of the Morgan interests in the Independent field claim to see in this move more proof that close relations exist between them and the Bell companies. They say that Independent rates were advanced as soon as the properties were safe in the New York fianancier's hands, but that Bell rates were left to run along as they were because of the litigation that followed his latest move. Many of the Independents have come around to Morgan's way of looking at the matter, they say, and now express themselves as satisfied with his policy.

On the other hand, it is said that Attorney-General Denman is on a still hunt for evidence that will enable him to bring proceedings. The defeat of the Woods public-utility bill in the last General Assembly has made it much more difficult to handle matters of this kind than it would otherwise have been. Had this bill been made a law, the rates could not have been changed in any way without the consent of the State Railroad Commission, but as it is, no questions need be asked. In all probability the readjustment will make the enactment of a similar bill certain by the next Legislature.

University of Pittsburgh Co-operative Plan of Engineering Instruction.

The trustees of the University of Pittsburgh have adopted a plan of co-operation recommended by the Committee on School of Engineering, which will be put into operation on Oct. 1, 1910. The committee which devised the plan, in its report stated that it has been a matter of common observation in connection with young men who enter the engineering field that those who spent their vacations while at school in engineering offices and industrial establishments have been better prepared for entrance upon their life's work than their fellow students of otherwise equal abilities who devoted their time exclusively to school work; and if the student of engineering is thus benefitted by such chance work as he may be able to get during vacation periods, he will be benefitted still more by pursuing a systematic course in which the instruction in school is interspersed with suitable outside practical work. It is further stated that the technical graduate who has taken school work only has no adequate knowledge of the organization which makes it possible for many men of diverse employment to work together as a single unit in the accomplishment of a desired result, nor of the system that is necessary for tying together interrelated departments for the attainment of economic production; and that he does not even know as a beginner how to apply the knowledge at school in a manner altogether satisfactory to his employer. Because of this unpreparedness of the average technical graduate, a number of large corporations have established student apprenticeship courses for the benefit of such graduates as seek employment with them.

To meet these conditions the Committee on the School of Engineering has matured a co-operative plan whereby the student, while spending in school the amount of time usually devoted to instruction in the best engineering institutions will work four terms of three months each, in the engineering industries of the Pittsburgh District. By this plan the student gets the usual theoretical course and in addition 12 months of practical work, all in the space of four years, the school work being arranged so that successive groups of students will furnish continuous service to the employer. The advantages of this plan are set forth as follows:

(1) Because of the opportunities to observe in detail the methods of production and the conduct of business, and the results of his contact with the men who are carrying on our engineering industries, he will be able to do his school work more effectively.

(2) He will, upon graduation, be of greater use to his employer, and many graduates will find good positions where they have done practical work on this co-operative plan, which they can fill satisfactorily from the start. In this regard the graduate who takes his course on the co-operative plan will possess a distinct advantage over the graduate who has taken school work only.

(3) The money consideration received for this practical work will be ordinarily sufficient to meet the tuition expenses for his entire course at the university. In all cases the student of engineering will be materially benefitted by thus early learning from actual experience the viewpoint of the wage-earner; and the money received will be to many students an item of no small importance.

While the university has made special arrangements with a number of our local concerns for the benefit of its engineering

students, and will co-operate with the management of these concerns in every way possible, yet the student will be considered as a direct employe of the concern. He will serve as a regular employe for six regulation working days each week, for which he will receive the regular wages of a student apprentice, and shall be expected to observe strictly the rules and regulations of the company, and shall work under existing labor laws and conditions, including those pertaining to liability for accidents.

The student will report to the proper instructor at the university one evening each alternate week for discussion of the work being done; and at the end of the term he will receive 20 credits when a written report of his work and observations during the term has been received and accepted by the instructor in charge.

Courses in civil, mechanical, electrical, chemical and sanitary engineering are offered by the School of Engineering of the university, in all of which there is incorporated the principle of co-operation. These five courses are arranged so as to be identical for the first three terms. This permits of developing the student to a certain extent along lines which are common to all engineering before requiring him to choose the specific course he is to pursue. These first three terms are looked upon as a probationary period in the sense that the nature of the work done by any particular student during this period will determine in the judgement of the faculty whether or not he is to be advised to continue in the School of Engineering.

Canadian Peat Plant.

A plant for the manufacture of peat into fuel is now in successful operation at Alfred, Ontario, a little French village about 45 miles from Ottawa. It has been established by the mines branch of the Department of the Interior of the Dominion Government as a demonstration of the possibilities of the peat bogs, with which Canada, but more especially Ontario, abounds. The plant commenced operations on May 18 and is now running continuously under the supervision of Mr. A. Anrep, who is a son of Mr. A. Anrep, Sr., of Sweden, the inventor of the process used. There are some 300 acres of peat available at Alfred, the deposit going to an average depth of 10 ft., under which is clay.

The plant consists of a long peat storage shed, two small frame houses, a blacksmith shop and a large peat machine. The latter apparatus constitutes the main feature of the plant, which was imported from Sweden, where there are 500 equipments of this kind in operation. The method of operation is as follows:

A long trench, 19 ft. wide, is cut 8 ft. down in the peat, and the peat machine is placed in this. A carrier conveys the peat as it is dug from the trench to a hopper. On a 600-ft. circular track in the middle of the bog are eight peat carriers, each of which hold 0.7 ton of peat. As each car passes the machine the ground peat is dropped from the hopper of the latter into it. A 34-hp engine, which itself burns about 4 tons of peat fuel per day, furnishes motive power for both hopper and cable cars.

The next process is to convey the peat in the carriers to what is known as a field press. This spreads it upon the ground in long parallel rows and it is then shaped into bricks by means of a three-knived instrument, turned over by boys, and allowed to dry in the sun and air for three or four weeks, when it is stored in the peat shed ready for transportation.

The average capacity of the plant is 25 tons per day, though it can be run up to 30 tons. Altogether 14 men and two boys are employed. The men receive $1.75 per day and dinner, while the boys receive 8 cents for every 1000 bricks turned over. A peat worker's job, judged by the standard that obtains elsewhere in the Government service, is severe, as he works for 12 hours a day.

Mr. Anrep stated that he could produce peat at the Alfred plant for from $1.75 to $1.80 per ton. One and four-fifths tons of peat equal 1 ton of anthracite. It costs about 80 cents per 1000 bricks (about 1 ton) to manufacture and spread them; 8 cents per 1000 to turn and dry, 25 cents for stocking and moving, 20 cents to transport to Alfred station, which, allowing 35 per cent for overhead charges and 30 cents for extra labor, means that the peat, delivered at Alfred station, costs the Government from $1.80 to $2 per ton.

The peat will burn in any stove, but for houses a special stove is necessary on account of the fineness of the ash. Peat takes about twice as much room for its weight as coal, and it is an excellent fuel to use in connection with producer gas.

The Alfred peat bog is practically useless for agricultural purposes, so that its employment as a source of fuel means the reclamation of land otherwise waste. The importance of the peat deposits of Ontario in connection with the future of the coal-lacking province has been long recognized by the mines branch under Dr. Eugene Haanel, its director. A peat-using plant for the production of producer gas has been established in Ottawa and receives its fuel from the peat manufacturing plant at Alfred. The American Peat Society, which meets in Ottawa on July 25, 26 and 27, will visit the Alfred plant.

Electric Power from the Trent River, Ontario.

A large number of delegates of councils and boards of trades of different municipalities met at Belleville, Ontario, on May 31, to discuss the feasibility of a power union to distribute electric power from the Trent River.

In addition to the representatives of the Trenton Electric and the Seymour Power Company, Messrs. J. G. G. Kerry, of Toronto, and A. B. Colville, of Campbellford, and the Northumberland & Durham Power Company (represented by Mr. J. Alex. Culverwell), the municipalities of Port Hope, Brighton, Cobourg, Napanee, Belleville, Picton and Kingston were present.

A resolution was introduced by the Picton board of trade to form a power union similar to the one existing in western Ontario for the distribution of Niagara power, but this motion was withdrawn on account of general disapproval. As the rates of the companies will be regulated by the Ontario Railway and Municipal Board, the consumers must deal directly with the companies.

The Trent River dams are being constructed by the Dominion Government, which is also carrying on the canal construction. Mr. Culverwell, the managing director of the Northumberland & Durham Power Company, announced that his company is prepared to spend $2,000,000 on the scheme, while the Seymour Power Company is willing to furnish power under Government regulations.

Exportation of Canadian Electric Energy.

On May 23 the executive committee of the National Conservation Commission of Canada had under consideration at Ottawa the application of the Ontario & Minnesota Power Company to export energy to the United States from Fort Frances, Ontario, as referred to the commission by the sub-committee of the Dominion Government Cabinet Council, which heard opposing representatives on the matter from both the company and the town corporation on Saturday, May 21.

Mayor Williams, of Fort Frances, and James Conmee, M.P., again presented arguments against allowing the company to export energy until full provision has been made for meeting all the needs of Canadian consumers of electric energy in the vicinity of Fort Frances. The solicitors appearing for the company maintained that there was no demand for the energy on the Canadian side at present, while there is now a good market to be had for the energy from consumers on the American side of the river.

On June 6 the Canadian Government decided to allow 3500 hp to be exported, an equal amount being reserved for consumption on the Canadian side.

Physiological Effects of an Alternating Magnetic Field.

In a letter to the London *Electrician*, Mr. A. A. Campbell Swinton discusses the subject of electromagnet physiological effects, which formed the topic of a Royal Society paper by Prof. S. P. Thompson, reprinted in our issue dated May 12. Mr. Swinton supported the view of our contemporary that any physiological effect due to an alternating magnetic field, such as mentioned by Professor Thompson, is ascribed to induced currents rathen than to any magnetic cause pure and simple, and said that it is easy to produce the visual flickering effect by passing through the head the current from an ordinary direct-current magneto generator, such as is supplied with the Evershed ohm-meter.

One terminal of the generator should be held in one hand, while a wire from the other terminal should be held in the other hand in contact with a small piece of wet sponge, and the latter pressed lightly on one side of the head just behind the eye. If the generator handle is then slowly turned (and it is wise to turn it slowly to avoid unpleasant results) the flickering effect will at once become very noticeable; and as the frequency of the flicker increases with the speed of revolution it apparently is connected with pulsations in the current due to the slow revolutions and the few segments on the commutator. The current through the head must be very small, as the bulk of that generated goes from hand to hand through the arms and body. Mr. Swinton said he first noticed this phenomenon some 12 or 15 years ago when treating himself electrically for neuralgia, but believes that the effects of electric currents on vision have been known much longer than that. Passing electric currents through the head in certain directions also produces a metallic taste in the mouth.

Electrodeless currents in the body, produced by electromagnetic induction from a coil carrying so-called high-frequency currents, have, of course, been in use in medical practice for some years.

Employing as primary a coil of wire of many turns, and some 2 ft. in diameter, carrying high-frequency currents from the discharges of a large battery of Leyden jars, and using as secondary the body and the two arms bent so as to form a circle, sufficient current can be induced in the circuit formed by the arms and body to light a miniature incandescent lamp connected between the two hands; or a sufficient difference of potential can be produced between the two hands to cause small sparks to pass visibly between them when they are held near together.

Positions Held by Electrical Engineering Graduates

Statistics just compiled show that, of the 383 graduates from the department of electrical engineering at the University of Wisconsin, a large part are holding responsible positions in electrical manufactories, central stations, telephone or industrial plants, or in educational institutions. Nearly one-fourth, 97 students, or just 24.5 per cent, are engaged in electrical manufactories throughout the country; 70 in the actual engineering work of testing, designing, erecting and supervising the making of electrical machines; 23 in the sales and advertising departments, and four in executive offices.

Government positions have been secured by 16 of the electrical course graduates, two being in the United States Reclamation Service, one on the Coast and Geodetic Survey, and two on the Panama Canal construction. State positions are held by nine, of whom eight are on rate commissions, and two others are employed by municipal rate commissions. Central stations engage 17.5 per cent of the graduates, 69 students being employed in such work. Of these 43 are general or operating engineers, apprentices, testers or inspectors; two are salesmen, and 24 are general and assistant managers and superintendents.

Those engaged in teaching their profession to others number 38, or 9.6 per cent of the electrical graduates, including 14 university and college professors, nine instructors and six assistants in technical schools, three in the liberal arts colleges, three in academies and high schools and three in Y. M. C. A. and grade work. Telephone companies have employed 32, of whom four are managers and assistant managers, and four are foremen.

Railway engineering occupies 10, of whom seven are on steam roads and three on electrical lines. The mining profession was chosen by four, while 10 others chose to become consulting engineers, three on their own account and seven for corporations and companies.

Industrial concerns employ 25, or 6.3 per cent, of the men, 11 in executive capacities as managers and superintendents, and 14 as plant engineers and general assistants. Contract and construction work has engaged the attention of seven more, while 13 are in generating and transmission plants.

The Patent Situation.

The June number of the *North American Review* contains a paper on the patent situation by Mr. William Macomber, the title being "Patents and Industrial Progress."

The author contends (1) that the grant of a patent should afford substantial ground for assuming that the thing patented is novel and that the patent is valid; and (2) that the means for determining the novelty and validity of a patent—the final, judicial determination of these questions—should be certain, speedy and inexpensive.

To meet these conditions, the commissioner (1) should be allowed to use the surplus the Patent Office has earned to erect and equip a plant adequate to the needs of the business; to cooperate in a revision of the fee schedule to materially increase the revenues without additional cost to the patentee, and be permitted to use the earnings of his department to make the work efficient. (2) There should be established at Washington a Court of Patent Appeals. To this one central court every appeal from every patent judge should be taken and that court should be given final appellate jurisdiction. It should be composed of five judges, all of them trained in the patent law. The method of appeal should be by case and exceptions; the record made by counsel and settled before the patent judge who heard the case, to the end that the present enormous cost of printing may be reduced and that the Appellate Court may not be burdened with a padded and cumbersome record.

The Electrical Policy of the Sanitary District of Chicago.

Mr. Robert R. McCormick, president of the board of trustees of the Sanitary District of Chicago addressed a well-attended meeting of the Electric Club, of that city, at the weekly luncheon on June 1. Mr. McCormick made a broad-minded and instructive address, devoted principally to the hydroelectric development of the Chicago Drainage Canal, and his remarks were received with approval and applause. He began by discussing the functions of government—what may properly be assigned to public and what to private enterprise. While it is difficult to draw a sharp line between Government and private enterprises, the speaker thinks that, as things are, street-railway, gas and electric-lighting utilities may best be conducted by private ownership. On the other hand, water works, sewage disposal and all other undertakings relating to the life and health of the community are clearly functions of Government.

The Sanitary District of Chicago has built and is operating the greatest sewage-disposal enterprise the world has ever seen. Mr. McCormick thinks that this great undertaking should remain primarily an agent for the disposal of sewage, only executing such other duties as are incidental to its main purpose. It is evident that the water-power created by the Drainage Canal is intrinsically a part of the enterprise. How this water-power may be utilized is purely a question of business. It was decided to build a plant, and the president of the district sketched briefly the negotiations with the city relating

to the use of the electricity produced by this plant for the street lighting of Chicago. The city some time ago agreed to take part of the energy for this purpose, and the district started out to sell the remainder. In doing this, it had an interesting experience. There was not enough electrical energy to supply the entire field, and those whom the district could not reach had to take "something just as good."

In the meantime, a very large proportion of the city of Chicago was and is inadequately lighted. This caused Mr. McCormick and his colleagues to reflect. The energy to supply this lighting was in existence and in their control; the greater part of it was not used, and it ought to be used. Therefore, after studying the question, a point was reached where it was proposed to finance the street lighting of the whole city, for the city of Chicago had reached the limit of its bonded indebtedness, and could not itself raise the necessary funds. This deal, in the rough, has gone through, and the engineering work of laying out the plans has been begun. (See *Electrical World* of May 19, page 1242.)

But after the street-lighting needs of the city of Chicago are supplied, the Sanitary District will still have some electrical energy left. How shall it be used? Mr. McCormick believes that the surplus will be, partly and temporarily, sold commercially, but he referred also to the proposed electrical operation of city water-works pumping stations, with steam auxiliaries for emergency. The Sanitary District might well supply the electricity for this purpose, and the president of the district thinks this plan will go into effect ultimately. He remarked that the Wilmette pumping station of the district is being equipped entirely for electrical operation, and that the Thirty-ninth Street sewage pumping station of the same body is equipped for electric drive to the extent of one-half its rating.

The Sanitary District should supply all the public needs of the city of Chicago for electrical energy. Mr. McCormick spoke of the diversity factor as the secret of central-station success, and he said that the same principle should be applied in the relations of the Sanitary District and the city. All the departments requiring electrical energy, as street lighting, water works, parks, city hall, public library, etc., should be connected with the Drainage Canal source of supply, and, as in the case of a private enterprise, the diversity factor would enter into such an extent that the total connected load might be two or three times greater than the maximum rating of the generating station. The adoption of this plan would result in great economy to the city of Chicago—possibly a saving of $3,000,000 or $4,000,000 a year.

In concluding, Mr. McCormick gave it as his opinion that the general supply of electric light and power for commercial and residence purposes should be controlled by private capital. Perhaps in the distant future the two supply systems of Chicago —public and private—may be tied together, so that in time of great emergency, say a conflagration like the great Chicago fire in 1871, every generator in Chicago may be used for supplying electricity to operate fire-pumps. To look forward to a time when the two systems may be used to support each other in this manner is a vision, but an entirely practicable one. The realization of the idea will be brought about only through the good management and absolute efficiency of the public enterprise. Mr. McCormick declared it to be his intention, so long as he remained in office, to maintain the efficiency and honesty which no man can deny exist to-day in the management of the Sanitary District.

The speaker's remarks were cordially received. To one questioner, Mr. McCormick said that the Sanitary District has not sufficient output to operate the street railways of the city. The ultimate capacity of the present plant is about 30,000 hp. The district is restricted by the United States Government to a consumption of water from Lake Michigan not exceeding 600,000 cu. ft. per minute. Mr. H. E. Niesz, general manager of the Cosmopolitan Electric Company, alluded in terms of praise to the work of the Sanitary District in financing the city's street-lighting problem, and in conclusion, moved a vote of thanks to Mr. McCormick, which was adopted unanimously.

Selection of Electric Railway Apparatus.

At a joint meeting of the Chicago section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, held in the rooms of the latter on June 7, Mr. Frederick Darlington read a paper entitled, "Economic Considerations Governing the Selection of Electric Railway Apparatus." Mr. Darlington's paper was on the same general subject as an earlier address before the Electric Club of Chicago on April 20, when he discussed, "The Problem of Steam-Railroad Electrification."

The speaker showed at the outset that there is no general rule by which the cost of electrical equipment for railways may be determined, because this cost is affected by so many conditions; for some parts of the equipment, it depends on the weight and frequency of trains and the power used per train, and for other parts it depends upon the length of track to be electrified and upon local conditions.

There are three well-known systems used in electric traction —the direct-current system; the single-phase, alternating-current system; and the three-phase, alternating-current system. Mr. Darlington discussed the relative merits of these systems briefly from the viewpoints of reliability and of economy of construction and operation. Taking up first the generating plant, he said that here the costs of the three systems do not vary greatly. Ordinarily the cost of steam-turbine plants for railway electrical operation is from 25 to 40 per cent of the total cost of the electrical equipment.

The power transmission and distribution system forms the largest part, or at least a very large part, of the cost of electrification in heavy railway work. Where direct current is used, the power transmission and distribution usually costs more than either the power plant or the electric locomotives and motor cars, and is probably between 40 and 60 per cent of the total electrification cost. With single-phase apparatus, the electric-power transmission and distribution is greatly simplified and cheapened. Where three-phase apparatus is used, high-tension, alternating-current trolleys are employed, and three conductors are necessary to carry the current for three-phase motors, so that two separately insulated trolley wires are necessary in conjunction with the track rails. Three-phase motors under varying loads require more uniform potential than is necessary for either single-phase or direct-current motors, and it is necessary to locate transformer stations closer together on three-phase lines than on single-phase lines. From these and other considerations, the cost for the three-phase transmission and distribution system will be probably from 30 to 80 per cent more than for the corresponding single-phase system.

The direct-current and single-phase motors used for railway operation were described. Single-phase railway motors are heavier and more expensive than direct-current motors of the same rating. Designers say that the difference is between 10 and 25 per cent in weight, and 25 to 50 per cent in cost, in favor of direct-current motors. In locomotive design, it may be assumed that the single-phase locomotive will be about 15 per cent heavier than the corresponding direct-current locomotive.

Three-phase motors, unlike direct-current and single-phase motors, tend to maintain constant speed at all loads. They are light and durable and cheap to build, but where the track is level and straight and high speed is desirable, the three-phase motor cannot exceed a certain fixed speed, whereas a variable-speed motor can take advantage of this opportunity to make extra good time; furthermore, trains equipped with variable-speed motors can take advantage of velocity head or a running start in climbing short grades.

Taking up reliability of electric-railway apparatus, Mr. Darlington cited existing installations to show that an excellent operating reliability has been demonstrated for single-phase apparatus. The extensive use of three-phase motors in industrial practice points to an excellent degree of reliability in railway work. The direct-current railway motor has thoroughly established its reliability, of course.

As to maintenance, it is reasonable to suppose that single-

phase motors will cost more for repairs than direct-current motors, but this increase will probably add less than 10 per cent to the total cost of locomotive repairs. Likewise, the possible saving by the use of three-phase instead of direct-current or single-phase motors can never be a relatively large item. In relation to motor cars, the cost of repairs of the electrical equipment has long been known to be very low.

Comparing efficiency of distribution, Mr. Darlington said that with the single-phase system the loss in transmission and distribution is very much less than with direct current. The same statement applies also to three-phase distribution, but in a lesser degree, because with the latter system the transformer losses are greater in the aggregate.

Direct-current motors and three-phase motors are possibly from 5 to 7 per cent more efficient at full load than single-phase motors (taking transformer losses into account), but this difference is partly offset by the superior efficiency of the control of single-phase motors. The attendance and repairs of the moving machinery in direct-current substations add to the maintenance cost of the direct-current system at the rate of $2,000 to $3,000 per substation per year.

Finally, the speaker pointed out that the difference in cost or efficiency between the three systems is not nearly so great in the power house or in the electric motors on the trains as in the apparatus for the transmission and distribution of electricity from the power house to the trains. In making a choice, particular attention should be paid to this feature of the system.

Engineers Discuss Conservation of Natural Resources at Boston.

A joint meeting of the American Society of Mechanical Engineers, the Boston section of the American Institute of Electrical Engineers and the Boston Society of Civil Engineers was held at Huntington Hall, Boston, on the evening of June 1. President Lewis B. Stillwell, of the A. I. E. E., was the principal speaker, and presented a paper on "The Conservation of Our Natural Resources," special consideration being given to the subject of water-power and forestry. An extended discussion of the paper followed its presentation. Previous to the meeting President Stillwell was entertained at an informal dinner held in the Hotel Tuileries, Boston, at which the following gentlemen prominent in engineering circles in New England were present: President-elect Dugald C. Jackson, of the A. I. E. E.; Prof. Elihu Thomson; Dr. A. E. Kennelly; Prof. Ira N. Hollis, chairman Boston section of the American Society of Mechanical Engineers; Secretary Ralph W. Pope, of the A. I. E. E.; Prof. C. A. Adams; President H. F. Bryant, Boston Society of Civil Engineers; Messrs. C. T. Main, E. W. Holst, J. F. Vaughan, M. V. Ayres, G. W. Palmer, Jr., S. E. Tinkham, J. H. Libbey, Geo A. Kimball, R. N. C. Barnes, G. A. Rodenbaeck, L. L. Elden, A. L. Pearson, F. P. Valentine, N. J. Neall, F. L. Hunt, L. A. Doggett, F. H. Silsbee, and Mr. H. S. Knowlton, representing the *Electrical World*.

Mr. N. J. Neall, chairman of the committee on arrangements, called the party to order at the close of the dinner, and referred to the co-operative endeavors of engineers in Boston and vicinity in the past few months, leading to the investigation of a plan for erecting an engineering building and clubhouse in which should be centered the interests of technical men in this district. Prof. I. N. Hollis reviewed the studies which have been made for such a building, stating that about 15 engineering societies are interested in the project. The plans are based upon the establishment of a permanent home for the several societies, clubhouse facilities, a joint library, auditorium and mercantile quarters. Thus far 350 men of standing have signified their intention of joining forces with the enterprise. It is uncertain at the present time just how far these plans can be carried out, but a vigorous attempt will be made to set in motion an enterprise which will permit of further expansion and which will solidify the influence of scientific men in the Boston district. The time is ripe for the engineer to make himself felt more powerfully in public affairs.

President Bryant, B. S. C. E., said that the proposed clubhouse will do more to exalt the engineer in the community than any other thing. He advised taking some risk in connection with the enterprise on the ground that the ultra-conservatives will be sure to join hands with the pioneers as soon as matters are well under way. Prof. Elihu Thomson spoke of the embarrassment of riches existing in multiplied societies and stated that he was heartily in favor of the scheme, provided that it proceeds on lines which will permit expansion instead of attempting too broad a plan at the outset, and without injuring the national societies. President Stillwell spoke of the inspiration of being in touch with engineers in different parts of the country, and emphasized the good accomplished by joint meetings in Boston and elsewhere. He felt that bringing local societies together helps the national organizations. A most valuable feature of the joint meeting is the opportunity afforded for the wider publicity of the papers presented and discussed. There are 20,000 professional engineers in the societies of America, and the benefits of close association are being felt all along the line.

At the Huntington Hall meeting President-elect Jackson announced that the following officers have been elected by the Boston section of the A. I. E. E. for the ensuing year: Chairman, Mr. J. F. Vaughan; vice-chairman, Prof. William L. Hooper; secretary and treasurer, Mr. Harry Hope. President Stillwell was then introduced, and read his paper on conservation, reviewing the work which has been accomplished since the celebrated conference of Governors called at the White House two years ago by President Roosevelt; discussing the differences of opinion between Chief Hydrographer Leighton, of the U. S. Geological Survey, and Dr. W. L. Moore, chief of the U. S. Weather Bureau; and calling attention to certain clauses of the contract agreement now enforced by the Forest Service in connection with water-power appropriations, and to a fundamental defect of the existing law relating to the matter which is standing squarely in the path of true conservation.

President Stillwell showed how the work of the various committees and commissions interested in conservation has proceeded toward a definitely constructive policy. A bill endorsed by the present Administration is now before Congress, which, if passed, will confer definitely upon the President and his executive assistants the full authority in respect to withdrawal of public lands and water-powers claimed and exercised by the last Administration. Presumably the bill will pass, and if so we may expect that the question of governmental machinery and methods for handling practically this highly complex and important subject will be raised again in acute form. No time could be more opportune for calm and rational discussion of the subject than the present—a time when both the sentiment of the public and the views of their political leaders may be influenced by the presentation of pertinent facts and opinions. If the views of scientific men are to be effective, either in molding public opinion or in assisting the legislative and executive representatives of the people by supplying facts essential to correct deductions, it is highly important that apparent lack of agreement among experts shall not destroy their influence. The author then passed to a discussion of the analyses of forestation and stream flow which have been made public by Messrs. Leighton and Moore, with the conclusion that each of these experts has been looking at the problems from a different point of view, and that the opinion is generally, if not unanimously, held that, other things being equal, the presence of a forest on a watershed does materially regulate the run-off, although it is impossible to fix a general quantitative relation between forest and stream flow applicable to the widely divergent conditions existing in various parts of the United States. The right of the Government to charge for water and head from Government reserves is not dependent upon its ability to demonstrate that the preservation of the forest adds to the value of the water-power. That right is analogous to its right to exact a royalty for coal mined and logically is as applicable to the run-off from Government lands

outside the limits of the forest reserves as to the lands within those limits.

President Stillwell said that he has yet to find a representative man directly interested in water-powers who takes the position that private appropriation of these powers for unlimited periods should be permitted. In order to induce capital, however, to undertake prompt development of our water-power resources, the term of the franchise must be sufficient to enable the grantee to amortize his capital investment without burdening the enterprise by the necessity of setting aside annually an excessive amount as a sinking fund. The 50-year term contemplated by the permit now in use will generally be considered reasonable. It is also wise and necessary to prevent speculation in water-power rights by requiring the work of construction to begin within a reasonable time and be prosecuted toward a progressive accomplishment. Regarding the question of State vs. Federal control of water-powers, there is need for a wider discussion by engineers.

In conclusion the author reviewed the methods of charging for water-power privileges practised by the Forest Service, including a rental charge for land and gross operation charge based upon the quantity of energy generated yearly, with deductions in cases where all the water utilized does not come from the Forest Reserve and the entire head developed does not result from the topography of the forest. President Stillwell said that the proposed conservation charge cannot be regarded reasonably as constituting any very serious financial burden upon the organization developing the energy. If energy sold at an average price of 1 cent per kw-hour, the maximum conservation charge during the first five years of operation is equivalent to a tax of 0.61 per cent of gross receipts, increasing gradually to a maximum of 3.25 per cent of gross receipts during the last five years of the 50-year contract. The average charge during the 50-year period is 1.84 per cent of gross receipts if the energy be sold at 1 cent per unit. If energy be sold at an average price of 0.5 cent per kw-hour the average conservation charge during the period of the lease becomes 3.88 per cent, and the maximum, 6.5 per cent, during the last five years.

Among the objections to the proposed plan are the following: The imposition of a tax upon output puts a premium upon the construction of a highly efficient plant; it imposes a heavier burden upon the man who sells his energy at a lower price than upon the one who charges a higher price; and incidentally the man who takes his energy to market, say, 100 to 300 miles away, must pay the Government for the losses incurred in transmission. The Italian law reduces the rental in case of transmitting energy.

These objections, while not readily overcome by alternative suggestions, are sufficiently serious to justify further effort to establish a conservation charge application open to less criticism. The non-transferability of the permit now fixed is aimed to avoid monopoly, but in view of the economic reasons demanding combination of water-powers and distributing networks, this should not be retained. Otherwise the consumer must in the long run pay for a higher investment in auxiliary steam or gas plants. Continuity of service is also improved by combination of water-power resources. Transfer should be permitted, subject to the approval of the Government. The danger that American communities in general, knowing their rights in the regulation of rates, will long submit to rates that are really extortionate is not comparable to the economic loss which is certain to result from the imposition of conditions limiting the opportunity for profitable investment. Even an assumed water-power of the largest conceivable size must sell its energy at a cost lower than the cost of competing steam-power. The established right of a State or municipality to fix rates is an absolute protection applicable by local governments best able to judge the conditions which determine what is an equitable charge. The clause providing for continuous operation with a specification of the minimum amount of energy to be generated in many cases presents an extremely serious difficulty to the power company. The influence of idle investment tends to prevent any shutting down of plants to create an artificial power famine. If it be necessary to retain such a clause, it should be accompanied by a provision permitting, with the consent of the Government, a reduction in the percentages originally fixed. The bestowal of the power upon a Secretary of Agriculture or of the Interior to make the conditions of investment less onerous involves no corresponding public risk, since that secretary would destroy himself politically who should grant such authorization without proper cause. No power company can afford to invest capital under a contract which leaves it in the power of a Government official to increase the burdens of the enterprise within the term covered by the permit, but the Government and the public can well afford to bestow upon a responsible official of the proper department authority to reduce these burdens upon proper application and presentation of valid reasons.

The contract agreement should contain a clause guaranteeing for a period not less than five years subsequent to its termination the fulfillment of contracts between the permittee and customers existing at that time. Under the law as it now stands the Forest Service can grant to an individual or corporation only a permit revocable by the Secretary of Agriculture in his discretion. Such is not an adequate basis for financing an enterprise requiring investment of capital. This vital defect of the existing law to-day stands directly in the path of legitimate and praiseworthy enterprise seeking to develop and utilize our many water-powers from forest reserves now wasted. Every proper influence should be brought to bear by those interested in the true conservation of our natural resources to secure a proper modification of the law, removing this otherwise insuperable barrier.

In opening the discussion Professor Jackson said that conservation means preservation *for* use—a point not generally appreciated. Prof. Geo. F. Swain brought out the point that capital must know the maximum unfavorable conditions before it will embark in an enterprise. He considered the inductive methods used by Leighton and Moore inapplicable to the large question of relation between forestation and flowage. The number of variable conditions is too great to deduce conclusions as one might if but a single factor could be varied and the effect noted. There is no question that erosion is greater on deforested areas, and that the result is interference with navigation. It is fundamentally clear that forests increase the steadiness of flow and maintain conditions that are favorable to navigability.

Mr. C. T. Main agreed with Professor Swain and emphasized the fact that water-power is by no means free, as many persons believe. The failure to develop such powers hastens the consumption of coal. Mr. Henry F. Bryant pointed out that his observations in the Green Mountain region indicated no effect on the run-off of streams due to lumbering. He considered it unnecessary to worry about the forest situation in New England, and urged the wisdom of keeping free from sweeping deductions in one part of the country based on conditions in another. The hydraulic conditions on streams that are apparently alike differ greatly. Professor Jackson emphasized the need of operating hydroelectric systems together for economical and reliable service, preferably under the supervision of State Commissions where oversight is needed. Dr. A. E. Kennelly pointed out that much depends on the gradient of stream basins, which has large influence upon the flowage. Engineers should discuss Government vs. State regulation more generally. The present assessment methods are complex and a uniform charge would presumably be better. Danger exists on account of excessive legislation relative to water-powers. Even under the worst conditions the country would gain more by the operation of a mismanaged plant 50 years than by having the possible development left alone. Special allowances should be made for long-distance transmissions. Closing, President Stillwell emphasized the mistaken ideas which prevail among the public as to the profits in water-power industries, and pointed out the necessity of substantial returns in order to attract capital to this field.

Massachusetts Legislative News.

The progress of the bill permitting the New York, New Haven & Hartford Railroad Company to acquire control of the Berkshire Street Railway has been delayed in the Senate by Senator Lomasney, of Boston, who succeeded in getting a postponement of action upon the measure. The matter came up again a few days ago and a successful fight was made to carry the bill through the upper branch, practically the entire population of western Massachusetts having expressed itself in favor of the project. As outlined before in these columns, the bill is designed to enable the New Haven company to coordinate electric and steam service west of the Connecticut River, including the building of many miles of new trolley line between towns which have for half a century been going down hill for lack of transportation facilities. The committees on railroads and street railways, sitting jointly, have issued a favorable report on the bill, and since this report petitions in its behalf have continued to pour into the State House from the community to be benefited. The railroad company plans to expend $2,000,000 almost immediately if the bill becomes a law, the money being required for the improvements and extensions mentioned in previous issues of this paper. A prominent feature of the policy of the New Haven management, if the bill goes through, will be the establishment of a highly efficient trolley express service in the Berkshire district, covering many points which are now reached only by teams. Senator Turtle, who is sponsor for the bill, made a strong speech pointing out the thoroughness with which the subject has been discussed before the General Court during the last three years, and deprecating further delay which would interfere seriously with the introduction of the new facilities during any part of the present season. The bill has now been passed to be engrossed and sent down for concurrent action. The committee on metropolitan affairs has voted in executive session to report favorably upon the bill to permit the Boston & Eastern Electric Railroad Company to build a tunnel under Boston Harbor. A provision has been added to the bill that the Railroad Commission shall issue the certificate of exigency to the company. The bill to authorize the Boston Elevated Railway Company to hold the stocks and bonds of other street railways has been given a second reading in the Senate. Many amendments of this bill are under discussion, one of the most prominent being that of Representative Wolcott, of Milton, who desires to have the Boston Elevated completely absorb the street railways which it takes over, in preference to the exercise of the holding privilege. The relations of the company's earnings to taxation upon various subway and tunnel investments of the city of Boston complicate the question to a serious degree. It is expected that a thorough discussion of the whole situation will take place this week in the House. The bill limiting the time for constructing electric railroads has been read in the Senate, and the resolve providing for an investigation of the electrification question at Boston has been given a second reading in the same branch.

Annual Report of Massachusetts Gas & Electric Light Commission.

The twenty-fifth annual report of the Massachusetts Gas & Electric Light Commission has been submitted in full to the Legislature, covering the year ending June 30, 1909. Returns are included from 67 gas companies, 57 electric light companies, 20 persons selling gas or electricity as individuals, and 27 municipal lighting plants. Four new companies were chartered during the year with gas or electric lighting powers. During the year covered by the report several consolidations of companies have occurred, the most important being the extension of the Boston Edison system into Newton, Watertown, Waltham, Brookline, Chelsea and Brighton. The board reviews its recommendations for legislation as published earlier in the present year and the orders and decisions of the commission during the year are reproduced in full. The correspondence in the celebrated Boston schoolhouse lighting case is given verbatim. After a thorough investigation in this instance the board was unable to require the lighting company to make a discriminatory rate in favor of the city's buildings under the care of the School Committee. Among the other important matters which were decided in the year were the Fitchburg and Worcester appeals against the Connecticut River Transmission Company's entering the local market for energy sales to small users, which resulted in the placing of a 300-hp limit on the Transmission Company; Leominster rates; Boston Edison minimum monthly charge; consolidations and security issues. Twenty applications for approval of issues of stock and bonds were decided during the year, the amount of securities asked for at par being $4,823,432, and the amount approved at par being $4,290,450.

Statistics published in the report show that the total income of the gas companies in the State was $10,871,534 in 1909 compared with $10,433,307 in 1908. The receipts from gas sold by meter increased by $426,312. Fifty-two gas companies paying dividends averaged a rate of 10.2 per cent on their stock. The 40 electric light companies which paid dividends averaged 9.39 per cent on their capital stock. The total income of the electric light companies in the State was $10,558,069, compared with $10,401,550 in 1908. The three principal sources of income were: Sale of energy for commercial lighting service by meter, $5,943,998; sale of energy for motors, $1,949,459; and sale of energy for street lighting, $1,972,667. On account of reductions in rates the revenue from metered energy in commercial lighting service fell off by about $150,000 in the year, compared with 1908. Revenue from street lighting by incandescent lamps increased $34,000 and earnings from street arc lighting dropped off by $29,000. The immediate income from sales of energy for motors is now about 18 per cent of the total, but in addition there is an improvement in operating efficiency due to bettered load factor which is not stated.

The total cost of manufacture, distribution and administration for the electric companies in 1909 was $6,279,046, compared with $6,145,599 in 1908. Dividends were declared to the amount of $2,144,202. The most important items of expense were: Fuel, $1,205,022; taxes, $829,512; station wages, $667,127; and repairs and renewals of lines, $519,643. It is a significant indication of the tendencies of the times when the single item of taxes exceeds the cost of plant labor by over 24 per cent. The total assets of the electric lighting companies June 30, 1909, were $43,328,929, of which $38,015,143 was charged to construction account, including franchises. Eighteen electric companies paid no dividends.

The body of the report is devoted to the usual analyses of prices charged for service, a new feature being a comparison of the maximum net kw-hour price for 1909 with that obtaining in 1908. The board states that the maximum net price affords a fair index of what the different companies are doing for their respective communities. The usual tabular history of municipal owenership activities in the State is given, covering the period from the inception of the industry to 1909. Under the caption, "Testing of Electric Meters," the board gives the results of inspections during the year ended Nov. 30, 1909, 42 such tests having been made. Twenty-four of the meters were found fast at full load, the maximum error being 9.7 per cent, and the average fast error approximately from 2 to 3 per cent. At one-half load 21 meters were found to be fast to a maximum of 5.9 per cent, the average fast reading being in the vicinity of 2 per cent. Eighteen meters were found to be fast at one-quarter load, the maximum error being 5.7 per cent. The largest meter tested had a rating of 600 amp and was found to be 1.7 per cent slow when run under full load in motor service. The majority of the larger meters tested were found to be slow rather than fast, while the smaller meters tested tended to indicate faster running, although the percentage errors found were in general smaller than in the large meters. There were 14 fatal accidents due to electricity in the year and 99 fatal gas accidents. The appendix of the report contains the usual details regarding assets, liabilities, income

and expenses of the private and municipal gas and electric plants, ratings of boilers, engines, generators, lengths of lines, underground construction, connected load in motors, kw-hours generated and sold, data as to lamps and customers, and laws passed by the Legislature of 1909 concerning gas or electric lighting companies. The report is signed by Chairman F. E. Barker, and Commissioners Morris Schaff and A. R. Weed.

Wisconsin Rate Commission News.

The arguments in the matter of the application of the Milwaukee & Fox River Valley Electric Railway Company for a certificate of convenience and necessity are now being heard by the Wisconsin Commission. The Milwaukee Northern Electric Railway Company is very strenuously opposing the granting of the certificate because of the competition which would result if the proposed road were built as planned. The road, if laid out as proposed, would parallel the latter's road for a considerable distance, with a consequent overlapping of the respective traffic zones. A vast amount of testimony has been presented by both sides relative to the necessity for such a road and the probable financial possibilities. Beside the route proposed by the petitioning company, there are three substitute routes, any one of which would be acceptable to the complainant, but which the petitioner claims are not feasible from a practical standpoint. This, however, is a matter for the engineers of the commission to decide. This application has been before the commission for nearly three years owing to the failure of the petitioner company to furnish sufficient data regarding its proposed plans.

A hearing was held on May 31 in the matter of the complaint of the city of Whitewater against the rates and service of the Whitewater Electric Light Company. As no objection was raised at the hearing to the engineer's valuation of the plant, the question of the rates will be decided by the commission on the company's financial report and the engineer's valuation. The question of service is also to be investigated by the engineering department and the decision rendered upon their recommendation.

On Aug. 4, 1909, the Platteville Gas Company applied to the commission for authority to issue capital stock and bonds to the amount of $100,000, which stock and bonds were to be sold for the purpose of producing money with which to pay for a complete gas manufacturing and distributing plant in the city of Platteville. On August 7 the authority was granted with the requirement that the company should file with the commission within thirty days after the application of the proceeds derived from the sale of said stock and bonds for the purposes authorized, a verified statement showing in detail the items to which the proceeds had been applied. Because the company has failed to file such a statement it was ordered to appear before the commission on June 2, and exhibit all books and accounts showing the application made of the funds and explain its non-compliance with the commission's order. The failure to live up to the conditions under which the bond or stock issue was granted is punishable by fine or the possible loss of franchise.

Massachusetts Commission News.

The Electric Light Company of Abington and Rockland has petitioned the Massachusetts Gas & Electric Light Commission for authority to issue 540 shares of additional capital stock at a price of $150 per share, the proceeds to be used to cancel floating indebtedness. The Massachusetts Railroad Commission has received a petition from residents of the city of Lawrence asking for an investigation of the fares and transfers in force on certain portions of the system of the Boston & Northern Street Railway Company within the municipality. The board will hear the case on June 22. A hearing has been set for June 21 upon the petition of the selectmen of Revere relative to fares and accommodations in that town.

The Massachusetts Gas & Electric Light Commission has revised the form of its annual return blanks and is sending the new folders to the various gas and electric companies in the State to be applied to the year ending June 30, 1910. The forms have been considerably rearranged in the interest of a more logical assembly of statistics; certain analyses hitherto omitted have been added and other data of less material value taken out, so that the return is two pages shorter than the previous standard. In the new forms the grouping of information is noticeably improved. Among the additional items of information required by the new forms are the particulars of any changes in name, business or location during the year; the amount of the Federal income tax; the subdivision of different kinds of gas-making plants, with full details as to the apparatus employed; classification of street mains on the basis of cast-iron, wrought-iron or steel piping; complete tabulation of public gas lamps supplied, with details as to the number, hourly consumption, yearly service and price of open-flame, mantle or other burners; manufacture of oil or acetylene gas; classification of labor; improved description of electric plants, including gas and oil engines, substation equipment, steel tower lines, analyzed connected load, including load curves on day of maximum and minimum output; place of delivery of energy sold to other companies or municipal plants; and simplified line statistics based on municipal, commercial lighting, and motor service.

The Worcester & Southbridge Street Railway Company has petitioned the Railroad Commission for authority to issue new stock to the amount of $140,000, in connection with the purchase of the Hartford & Worcester Street Railway Company. The commission has issued an order stating that in its opinion the public interest requires an elevated railway station at Green and Washington streets, Boston, following a petition by residents of the Jamaica Plain district for additional accommodations upon the Forest Hills extension of the Boston Elevated Railway Company. The board has authorized the Connecticut Valley Street Railway Company to carry baggage and freight in the town of Hadley. The commission has issued a decision sustaining the Boston & Northern Street Railway Company in the petition of the selectmen of North Reading for reduced fares. The application requested a 5-cent fare between Reading Square and Martin's Pond. The board points out in its decision that substantially the entire settled portion of North Reading is at present served for a single fare, and that patrons are able to ride to and from North Reading Center and Reading Square for the same amount. A ride is also obtainable from North Reading Center to and from Andover Square for 5 cents. The board says that, viewing this territory as a whole, it is of the opinion that the fares now established by the company are reasonable and that it ought not to make any recommendation for a reduction or readjustment of fares.

New York Public Service Commission News.

Mr. James E. Gaffney, of the Bradley-Gaffney-Steers Company, notified the Public Service Commission of the First District last week that his company was prepared to bid for the construction of the proposed tri-borough subway route, using its own capital, and also prepared to ask for the privilege of operating the route. If it is decided that the city shall build this subway with public money, Mr. Gaffney says that his company will put in bids for the construction work. It is now expected that the forms of contract will be ready for submission to the corporation counsel within a few days and that bids can be advertised for not later than June 15. It is believed that these bids can be opened and the awards made about Aug. 1. In the meantime the Board of Estimate and Apportionment is taking steps to provide city bonds for the construction if that method of building is preferred. A resolution was adopted last week providing for the drawing of a petition to the Appellate Division of the Supreme Court, asking it to set aside $44,250,000 of rapid transit bonds, exempting them from the debt limit. It is estimated that the city will have immediately available

for this work $57,250,000, and that before this amount of money is expended at least $60,000,000 of dock bonds will be exempted. In the actual construction work it is planned to begin building the subway sections some months before beginning the elevated sections, as it is recognized that the subways will require a much longer time for construction.

A petition containing more than 1000 signatures representing the taxpayers of East Flatbush and adjacent sections of South Brooklyn has been presented to the Public Service Commission asking it to lay out a rapid transit route from Eastern Parkway down Utica Avenue to Flatbush Avenue and out Flatbush Avenue to Jamaica Bay. The line would be about 3½ miles long, and it is proposed by the petitioners that it be constructed under the assessment plan.

Max E. Schmidt, president of the Continuous Transit Securities Company, has written a letter to the commission asking it to take up immediately the two applications for the right to build moving platforms in the center of New York City. The routes indicated in these petitions are under Broadway from Tenth Street to Forty-second Street and across town under Thirty-fourth Street. The law permitting the commission to grant such franchises has been signed by the Governor. In response, the commission wrote to Mr. Schmidt that it would be almost impossible to take up this matter for definite consideration until the plans for the construction of future subways has been absolutely settled.

The Public Service Commission, Second District, has authorized the Schenectady Railway Company to sell, transfer and assign to the United Traction Company all its right, title and interest in the franchises granted by the Common Council of the city of Albany in 1901, which franchise authorizes the Schenectady Railway Company to construct, maintain and operate an electric railroad for public use over and along Central Avenue in the city of Albany from a point at the intersection of Watervliet and Central avenues in the city of Albany to the western boundary line of the city where the same crosses Central Avenue. The Schenectady Railway Company is authorized to sell, transfer and assign to the United Traction Company all its right, title and interest to all fixtures, structures and sidetracks on the streets and highways referred to. The Schenectady Railway Company has also been authorized to lease to the United Traction Company a certain franchise granted the Schenectady Railway Company by the Common Council of the city of Watervliet in 1902, which franchise authorized the Schenectady Railway Company to lay tracks, erect poles and wires and operate an electric street railroad in and over Nineteenth Street, Sixth Avenue and Twenty-fifth Street in the city of Watervliet. The Schenectady Railway Company is permitted to lease to the United Traction Company all its right, title and interest to and in the railroad and all fixtures, structures, sidetracks and appliances now owned and operated by the Schenectady Railway Company in and over the streets and highways in the city of Watervliet. The commission has approved a traffic agreement made in 1908 between the United Traction Company and the Schenectady Railway Company in relation to the use of the tracks of the United Traction Company by the Schenectady Railway Company in the cities of Albany, Watervliet and Troy and the village of Green Island, which agreement provides that the Schenectady Railway Company may operate its passenger cars over the tracks owned by the United Traction Company in the city of Albany solely as agent of the United Traction Company and not otherwise, and that the Schenectady Railway Company as agent and not otherwise may operate its passenger cars over the tracks owned and leased by the United Traction Company in the city of Watervliet and Troy and in the village of Green Island.

The commission has denied the application of the North Shore Electric Light & Power Company, which sought permission to do business in the towns of Brookhaven and Smithtown, Suffolk County. There is already existing in that locality the Port Jefferson Electric Light Company. After a number of hearings the commission found that the territorial area now served by that company and proposed to be served by the applicant company does not now and will not in the immediate future afford a sufficient demand for electric current to make the operations of two companies therein successful or desirable. It found that the existing company had not at all times given reasonable and adequate service; that its plant and distributing system need additions and improvements; that, owing to its use of what is known as the flat rate, the rates charged by it are discriminatory; that its business methods have been lax and inefficient, and that successful operation of its works requires the supervision of a competent, practical electrician; that all the defects in the service of the existing company can be readily corrected by the exercise of the powers of the commission, when assisted by active co-operation of the company; that an adequate and satisfactory service can be given by it, thus avoiding an unnecessary duplication of plants, poles and wires in the streets and waste of capital.

On the hearings the existing company expressed a desire to meet the reasonable requirements of the commission, and such mandatory directions as to additions or changes in the plant itself, and as to its management and as to the character of its service as will best promote the mutual interests of the company and its patrons. Under these conditions the application of the new company was denied, on condition that the existing company shall, without service of complaint, make additions to or improvements or betterments of its plant and distributing system within six months from date; that it will, as soon as possible, employ a competent, practical electrician as superintendent of its plant, with full power to manage the affairs and business of the company, subject to the control and direction of the board of directors; that it will proceed with the utmost dispatch to correct such defects in its service as may be required by the commission; that it will change or modify its system of rates so as to avoid all discrimination. In case the existing company shall fail to comply with the terms of the resolution, the application of the North Shore Electric Light & Power Company will be granted. The Port Jefferson Company has filed with the commission an acceptance of the conditions imposed in its order.

During the present week the commission will give a hearing on the application of the Cayadutta Generating Company for authority to issue $30,000 in common capital stock and $20,000 of first mortgage bonds; the application of the same company for permission to construct, maintain and operate poles and wires for transmitting and furnishing electricity in the villages of Fonda and Fultonville, town of Mohawk, Montgomery County, and to exercise franchises granted by said villages and town; and also on its application for consent to the transfer from itself to the Cayadutta Generating Company (incorporated) the franchises, works and system owned and used by it for transmitting and furnishing to the public electricity for light, heat or power. The commission will also give hearings on that date on the application of the Huntington Light & Power Company for authority to issue and sell $150,000 in bonds to be secured by a first mortgage and to issue and sell $23,700 of its unissued capital stock; and the complaint of C. M. Boorn, of Seward, Schoharie County, against the Delaware & Hudson Company, asking for a sidetrack and switch connection between his property at Seward and the railroad.

A hearing will be given on the application of the Palmyra Gas & Electric Company for permission to construct, maintain and operate in the town of Palmyra extensions of its gas mains and electric wires and pole line, and for approval of the exercise of a franchise received by the company from the town board of Palmyra; and on the application of the New Light, Heat & Power Company, of Newark, N. Y., for permission to construct, maintain and operate in the town of Arcadia extensions of its electric wires and pole line, and for the approval of the exercise of a franchise received by the company from the town board of said town; also on the application of the Newark Gas, Light & Fuel Company for permission to construct, maintain and operate in the town of Arcadia extensions of its gas mains and for approval of the exercise of

a franchise received by the company from the town board of said town. The commission will also hear the complaints of residents of the villages of Lyons and Clyde against the Wayne County Electric Company and Lyons Gas Company as to price charged for electricity and as to inadequacy of energy supplied by said company for industrial purposes and quality of gas supplied.

Maryland Public Utilities Commission News.

Governor Crothers last week appointed Mr. Joshua W. Hering, the present State Comptroller, as the third member of the Public Utilities Commission, and former City Solicitor William Cabell Bruce as the chief counsel to the commission. By these appointments the Governor reversed his former policy of having two members of the commission appointed from the city, as both Mr. Hering and Mr. Laird are from the counties. Mr. Hering takes the place which was declined by Mr. Walter W. Abell.

When the appointments were originally announced the Governor declared his intention was to appoint one county man and two city men, in accordance with public sentiment. The city directly pays a large part of the salaries and the expenses of the commission, and out of the part paid by the State, more than one-half is collected as State taxes in Baltimore. Moreover, about two-thirds of the public-service corporations which will come under the supervision of the commission are located in Baltimore. Mr. Hering, the new appointee, is 75 years of age. While the public utilities bill was under consideration, as Comptroller a member of the cabinet, he took a prominent part in the debate. He was one of the State officials to declare in favor of the establishing of a commission applicable to all public-service corporations. In this last election he stumped the State and the necessity for the appointment of a public-service commission was one of his pet topics. He is a well-known banker of Carroll County, and formerly represented that county in the State Senate. In 1899 he was elected State Comptroller and was re-elected in 1901. From 1903 to 1907 he did not hold public office, but in the latter year he was nominated for Comptroller and elected on the ticket headed by Governor Crothers, and re-elected last November. Mr. Hering has already qualified as a member of the board.

Mr. William Cabell Bruce, the chief counsel to the commission, had been urged for membership on the commission. As a member of the State Senate and as the president of that body he rendered important services to the State, and for more than five years he was the City Solicitor, and in that position he made an enviable record. It is generally known that Mr. Bruce drafted and had passed many important city bills by the Legislature.

The commission is now complete with the exception of an assistant counsel, and this vacancy will be filled during the early part of next week. The commission has sent to every gas and electric company in the State a letter asking for information by August 15 regarding the capitalization and business of the companies. The information asked is as follows:

Copy of the charter of the company and, if consolidated, copies of the charters of the constituent companies. Statement of the capital stock at the present time and, if consolidated, the bonded debt of its constituent companies at the time of consolidation or merger. Statement of floating debt and bills payable. Copy of last annual report. Receipts and expenditures of the last fiscal year in detail, if same are not embraced in preceding request. Statement of the application of surplus income. Schedule of rates for electricity for domestic use and for manufacturing purposes and for municipal lighting. Schedule of rates for gas for domestic purposes (light and heat), for manufacturing and for municipal lighting. Statement regarding deposits by consumers, including the practice of requiring such deposits, when the practice was inaugurated and when discontinued, as the case may be; the present number of consumers; the present number of consumers having deposits and the minimum and maximum amount of deposits required and the average amount of all deposits on hand. The total number of deposits now on hand and the use made of the deposits funds. The total number of consumers who have made deposits and who have discontinued the service without withdrawing their deposits. The principal on hand covered by the preceding question and the accrued interest to date at the legal rate. The number of withdrawals of deposits that have been made up to date, the amount thereof together with interest allowed, giving the interest and principal separately, and the rate of interest allowed on such deposits. The number of withdrawals disapproved up to date, the amount thereof, and the reasons for disapproval. The method of recording the deposits. The rules and regulations respecting the withdrawals of deposits. A copy of the receipt given.

A complication has arisen concerning payment by the city of its share toward maintaining the commission, as no allowance was provided for it in the Budget. Mayor Mahool has stated that there will, however, be no trouble about the matter, as the Board of Estimate at its next meeting will probably decide to take the necessary amount, $8,800, from the general contingent fund.

Although the commission is expected to take some action in the establishment of a competitive electric light and power company for Baltimore, its hands are tied for the reason that it is not empowered to grant franchises, this matter resting entirely with the City Council. The Bloede ordinance was again tabled last week, and there seems to be little hope at present of the Patapsco Electric Light & Power Company entering the Baltimore field.

CURRENT NEWS AND NOTES.

Meeting of N. Y. E. S.—The annual meeting of the New York Electrical Society will be held on Wednesday, June 15, at 2 p. m., at the new passenger station of the Pennsylvania Railroad Company. At this meeting officers will be elected for the next year. Immediately after the business meeting the members will be given an opportunity to inspect the station building, which has not yet been opened to the public.

Control of Telegraph and Telephone.—According to a so-called "railroad" bill which has passed the United States Senate by a vote of 50 to 12, telegraph and telephone lines are placed under the jurisdiction of the Commerce Commission. The commission is authorized to determine the reasonableness of rates and a penalty is imposed of from $100 to $2,000 against granting franks or passes for the transmission of messages. Special night and press report rates are authorized. The bill provides for the creation of a Court of Commerce for the consideration exclusively of appeals from orders of the Interstate Commerce Commission. The Government, not the Interstate Commerce Commission, is to be the defendant in all cases coming before the court.

Three-Day Convention on Shipboard.—By what promises to be an agreeable variation from the usual program, this year's convention of the Northwest Electric Light and Power Association will be held on the steamer *Queen*, leaving Seattle, Wash., on the evening of Aug. 26, and returning on the morning of Aug. 29. The boat has been chartered for the trip, and will visit the various Puget Sound cities, with stop-overs at each place. The cost of the entire trip, including berth and meals, will be $10 for each person. An orchestra will be provided, and space has been assigned for the exhibits of supply companies which are members of the association. Papers will be presented on "Long-Distance Transmission," "Depreciation," "The Rate Question," "Employers' Liability," "Methods of Getting Business" and "Conservation." The combined convention and outing should prove not only exceptionally pleasant, but should give the delegates an unusual opportunity to get acquainted with one another and to discuss vital problems of mutual interest.

Europe-Argentina Cable.—The new cable line of the Western Telegraph Company connecting Europe with Buenos Ayres, Argentina, by way of Ascension Island, was opened for business on June 3.

International Congress of Inventors.—The International Congress of Inventors, an association with headquarters at Rochester, N. Y., has postponed its exhibition and meeting, which were scheduled to be held in that city June 13-18, to October next.

Canadian Electrical Association Convention.—The annual convention of the Canadian Electrical Association will be held this year at the Royal Muskoka Hotel, Muskoka Lakes, on July 6, 7 and 8. Mr. T. S. Young, Toronto, is secretary of the association.

Government Rebate on Tantalum.—The General Electric Company has been granted a "drawback" on tantalum lamps equipped with imported tantalum filaments. The amount is equal to the duty paid on the tantalum less the legal deduction of 1 per cent.

A Prosperous Electric Club.—The Electric Club of Chicago is accumulating a reserve of considerable size. At the meeting of June 1, Mr. F. J. Postel, the treasurer, reported that the association had cash on deposit in banks amounting to $3,340.43.

Convention of the American Street and Interurban Railway Association.—The annual convention of the American Street and Interurban Railway Association and its affiliated bodies will be held Oct. 10 to 14 at Atlantic City, N. J. As in 1908, the exhibits of the Manufacturer's Association will be located on Young's "Million Dollar" Pier.

Countermand of Car Orders.—The New York Central & Hudson River Railroad Company has decided to suspend a $5,000,000 project for improving its system and has requested the cancellation of a $3,000,000 order for cars on account of the injunction granted to the Attorney-General by Judge Dyer, in Missouri, restraining railroads from increasing their rates.

Safety of Steel Cars.—In a rear-end collision in the New York subway at midnight on June 1, when an empty wooden passenger car was demolished, the steel cars were damaged only to the extent of shattered windows and no passengers were injured except from flying glass. However, several persons were overcome by smoke from burning waste in a pumping station which had been the prime cause for the collision by hiding a danger signal from the view of the motorman on the second train.

Italian Hydroelectric Developments.—United States Consul Albert H. Michelson, of Turin, in his annual report relating to the industrial transactions in Italy and the Department of Piedmont, states that 13 concessions for the development of hydroelectric power in the Department of Piedmont, totaling 21,784 hp, were granted during 1909, against 24 concessions of 13,582 hp in 1908. The most important of the concessions of 1909 was for the development of 18,507 hp, for industrial purposes, in the Province of Cuneo.

Completion of New Colorado Hydroelectric Plant.—Gov. Shafroth, of Colorado; Mayor Speer, of Denver, and Mayor Green, of Boulder, will be present at the celebration to take place upon completion of the Central Colorado Power Company's Barker Meadow dam and reservoir near Nederland, which is set for Aug. 1. Wide publicity will be given to the readiness of the Central Colorado Power Company to furnish power in large amounts. The substitution of electric power for steam is being very rapidly accomplished, especially in the Boulder mining district.

Again the Monorail.—The proposition to install a monorail system for transporting passengers from Brooklyn to Coney Island in nine minutes is being revived. Mr. Clarence Ansell, of London, who is here in the interest of the Behr system, is reported as having said: "The car, which will seat 150 persons, will be run on a one-post elevated structure, and it will be quite possible to carry 160,000 persons a day without any strap hangers at a 5-cent fare. The trip will take exactly nine minutes, going at the rate of a mile a minute, and allowing for one stop between the two places."

Government Ownership of Electrical Utilities Proposed for Colorado.—Land owners in the vicinity of Grover, Col., want the Government to aid irrigation enterprises there, by which thousands of acres of fertile land may be watered from underground streams. A committee of citizens will lay the matter before the reclamation officers and may go to Washington to present the matter personally. The plan is for the Government to put in pumping plants, run by electricity, lift the water into reservoirs or pipe lines and supply settlers with water at a fair price. It is also desired that the Government put in electric light plants with the pumping plants and supply farmers with energy for lamps and for motors for running machinery on the farms.

Convention of the Mississippi Electric Association.—The second annual convention of the Mississippi Electric Association will be held on June 15 and 16 at Greenville, Miss. There will be two sessions, a morning and afternoon, on each day. After the delivery of addresses by Mayor Yerger, of Greenville, and President A. B. Patterson, of the association, the following papers will be read and discussed: "Grounding of Secondaries," by Mr. R. P. Strong; "Modern Steam Engines," by Mr. W. E. Griffin; "Depreciation," by Messrs. S. W. Greenland and Jack Abbott; "Tungsten Lamps," by Mr. A. H. Jones; "The Advantages of Electricity for Advertising Purposes," by Mr. C. E. Varney; "Uniform Rates," by Mr. F. J. Duffy; "The Care and Maintenance of Meters," by Mr. F. H. Mohns; "Public Policy," by Mr. F. H. Lotterhos.

California Water Power Riparian Right Decision.—The Appellate Court of the State of California has reversed Judge Head of the Shasta County Superior Court, of that State, who decided in effect that the Northern Light & Power Company cannot condemn farmers' riparian rights. The stream involved, Old Cow Creek, carries at its low stage in summer, roughly estimated, 3000 in. of water. Farmers living along the stream have irrigation ditches that divert 1000 in. of water, roughly estimated, to their land. This leaves 2000 in. in the creek, which is a riparian water right. The Appellate Court has said, in effect, that the Northern Light & Power Company may take this 2000 in. and devote it to a public use. The Northern Light & Power Company, or its successor, the Sacramento Valley Power Company; does not ask to take any water that the farmers have been using for irrigation purposes, but wants to take the surplus, which has never been used by anybody.

Annual Dinner of Lewis A. I. E. E. Branch.—Following the annual dinner of the Lewis Institute Branch of the American Institute of Electrical Engineers, Chicago, Friday evening, June 3, President Robert R. McCormick, of the Sanitary District of Chicago, delivered an address on "The Manufacture and Use of Electric Power." President McCormick traced the history of the development of hydroelectric power on the Drainage Canal, and justified the Sanitary District board, which was organized for sanitary purposes, in entering into the sale of electrical energy, just as it would prosecute the disposal to the best advantage of any other profitable by-product of the waterway undertaking. At the Institute Branch dinner, Mr. Frank Burch presided, and responses were delivered by Prof. P. B. Woodworth, Prof. John D. Nies and Mr. S. H. Martin. The officers of the Lewis Institute Branch elected for the coming year are as follows: Chairman, Mr. J. B. Johnson; vice-chairman, Mr. George Strachan; secretary, Mr. Adolph Fensholt.

Russian Electrical Exhibition.—An International Exhibition of Electricity as Applied to Railroads will be held at St. Petersburg from Aug. 28 to Nov. 28, 1910. The exhibits will be under the control of the Imperial Russian Technical Society, St. Petersburg.

Electric Signs on the Ocean.—Considerable alarm has been aroused among the property owners and others at Atlantic City by the report that a $500,000 company has been organized to erect and operate gigantic electric signs to be mounted on floats and anchored off the board walk.

Organization of Wireless Telegraphers.—At the National convention of the Commercial Telegraphers' Union, to be held in Chicago on June 13, President S. J. Konenkamp will complete arrangements for the formation of a branch of the Union to be known as the "Wireless Division."

Federal Control of Telephone and Telegraph Companies.—An amendment to the Federal railroad bill offered by Senator La Follette and adopted by both House and Senate provides for the extension of the jurisdiction of the Interstate Commerce Commission to interstate telephone and telegraph lines.

Prevention of Industrial Accidents and Diseases.—On June 10 and 11, at the Auditorium Hotel, in Chicago, will be held three national conferences relating to the prevention of accidents and diseases among laborers. The meetings will be under the auspices of the National Conference on Industrial Accidents and Workmen's Compensation, the International Congress of Industrial Hygiene, and the American Association for Labor Legislation

Gift to Stevens Institute.—At the commencement exercises of Stevens' Institute of Technology, Hoboken, N. J., president Homphreys announced the legal transfer of Stevens' Castle estate to the institute. The institute will also receive 4½ acres of property adjoining the present land and an option on 7 or 8 acres belonging to the Robert L. Stevens' estate.

Colorado Electric Club.—At the weekly luncheon in Denver of the Colorado Electric Club, on June 2, an instructive talk was given by the Hon. Robert W. Bonynge, of the United States Monetary Commission, on our present monetary system and our bank credit system in this country, touching upon the causes and cures for panics, and the means of restoration of public confidence.

Fixture Dealers' Association.—The National Lighting Fixture Association, composed of manufacturers and dealers in gas and electric fixtures, was organized in Detroit on June 6. The following officers were elected: President, Mr. Albert Morreau, of Cleveland; vice-president, Mr. A. E. P. Enos, of New York; secretary, Mr. J. F. Byrnes, of Chicago, and treasurer, Mr. Ford S. Smith, of Detroit. The industry represented by the organization numbers about 7000 manufacturers and dealers.

Electric Railway Travel in Buenos Aires.—The electric railway companies of Buenos Aires, Argentina, carried 281,712,392 passengers in 1909, as compared with 255,073,846 in 1908 and 225,040,746 in 1907. Their receipts for 1909 were: Anglo-Argentine, $11,083,698; Lacroze de Buenos Aires, $1,434,600; Electricos del Sud, $67,079; Puerto y Ciudad de Buenos Aires, $182,518. All these companies' receipts were from 4.5 per cent to 6 per cent greater in 1909 than in 1908.

Music on Tap.—The telephone company in Wilmington has equipped a department with phonographs and has on file a complete line of records. When a subscriber wants music he asks for the music operator and selects from the music catalog, supplied to all subscribers, the record he desires to hear. The result is as good as though the phonograph itself were transported to the receiving end of the line. The charges are 3 cents for regular records and 7 cents for those by operatic stars.

Sturdy Tungsten Lamps.—An English contemporary makes note of the following severe test which was withstood by tungsten lamps in Glasgow, Scotland: A heavy awning of the roll type, such as is usual in Europe, was blown down by the wind and two brackets equipped with osram lamps which were installed beneath the awning bore the whole shock of the load, which was so great as to break the wooden roll that is fastened to the front edge of the awning, and deflected the metallic brackets by about 7 in. The lamps, it was found, were not in the least injured by the shock.

Canadian Power for Detroit.—A recent item in a Toronto newspaper stated that a plan is under way to bring electric power into Detroit via the new Detroit River tunnel being completed by the Michigan Central Railway Company. The parties interested in the proposed enterprise are said to be Mr. William C. Kennedy, president of the Windsor Gas Company; Mr. John Davis, formerly inspector of inland revenue of Windsor; Mr. George M. Hendrie, of Detroit; Mr. M. J. Dee, of Detroit, and Mr. O. E. Fleming, of the law firm of Fleming & Drake. When asked recently concerning this report, Hon. Adam Beck, chairman of the Hydroelectric Commission, stated that there was no foundation for such a report.

Isolation of an Ion.—At a meeting of the Sigma Xi Society Professor Robert A. Milliken, of Chicago University, announced the successful results of experiments carried on to prove the kinetic theory of matter. A single particle of oil vapor was introduced into a space which contained air and was capable of being subjected to electrostatic strain. This particle of oil would take up one or two ions and while in motion the action of the electric field and gravity were contrasted and the observation applied to the energy relations according to the kinetic theory, conclusively substantiating the theory. It is claimed that in this way it had been possible to isolate a single ion for an hour or more at a time.

Southern Hydroelectric Development.—The Geological Survey of Georgia has recently issued a bulletin containing a list of water-powers of that State, together with a map showing the course of different streams and a number of tables giving data concerning each stream. The report divides the State into six river basins, and gives the minimum available power for the State during low-water periods as 491,650 hp, and the maximum during the six high-water months as 799,873 hp. In all of the estimates only 90 per cent of the actual fall of the streams has been given, and the indicated horse-power has been reduced in most cases to 80 per cent so that the results are considered to be quite conservative. No allowance was made for storage, which in many cases would increase the minimum power by from 200 to 300 per cent, nor has the report considered a great number of small streams, which it is estimated would approximately equal the water-power now being utilized in the State.

Wireless in Brazil.—Consul-General George E. Anderson, of Rio de Janeiro, states that a contract has been signed between the Lloyd Brazileiro, the subsidized line of steamships serving Brazilian ports and maintaining a service between Brazilian ports and New York, and the United Wireless Telegraph Company, of New York, for a wireless telegraph system upon 21 ships of the Lloyd line and eight stations along the Brazilian coast. One land station is to be at Rio Grande de Sul, one at Santos, three in and near Rio de Janeiro, one at Bahia, one at Pernambuco, and one at Para. The system will afford communication between Rio de Janeiro and all the Lloyd fleet all the time, except the New York service when ships are out of range. Most of the passenger ships between Europe and South America and two ships running between New York and the eastern coast of South America are already equipped with wireless apparatus, and the proposed system will give a wireless service in the South Atlantic similar to that in the North Atlantic.

ELECTRICITY IN FRENCH GAS PLANT.

Uses of Electrical Energy in the City of Paris Gas Works.

By WARREN H. MILLER.

THE use of electric energy for all manual operations in connection with charging, cleaning and serving gas retorts has been adopted to a certain extent by large gas companies in the United States, so the features of the plant described below will not be altogether novel. However, since the entire engineering and construction of this plant were undertaken by the engineers of the Société Française Thomson-Houston, it represents in a fair way the latest practice in French mechanical and electrical engineering. The gas works is one of the numerous subsidiary companies operated by the municipality of Paris to provide the city gas supply, and is located at Landy, a suburb to the north of the city about two miles beyond the gates.

Electric motors are used to operate long conveyors for handling the gas-coal, crushers, short ash conveyors, retort-charging machines, pushing machines for driving out the red-hot coke, and, finally, the entire plant is lighted by electricity. The plant requires about 1200 hp, used at 220 volts. The retort-charging machines consist of a rigid wheel truck, running on standard gage tracks across the front of the retorts, so as to serve each in turn. The truck platform carries a variable speed motor, operating a pulverizer, and high-speed flywheels which shoot out the powdered gas-coal horizontally with great velocity in a small stream. The machine receives a charge in its bin from the conveyor and is run in front of the open manhole of a retort. The motor is then started and shoots out its charge of coal-powder, giving it velocity by passing it around the groove between the two flywheels. The jet has force enough to reach clear to the back of the retort, and charges it solid from there to the mouth. This machine is always busy and there is one between every two benches of stills, in all about 10 of them. The pushing machines are of the same number and their office is to drive out the hot coke from which all the gas has been given off. They are mounted on rigid trucks, and the platform carries a motor operating a train of gears and rack-and-pinion movement, which advances the plunger some 14 ft. into the retort. The door at the other side is left open and the hot coke falls down into a conveyor which runs it under a quenching jet, after which it tumbles out into waiting carts which deliver it over manholes in the firing alleys between the retorts, where it tumbles below into the hearths of the distillate furnaces. There is nothing in any of this application of electric energy which precludes the use of three-phase alternating current, but the French engineers chose direct current probably because it is better known in France and also because of the better starting torque for heavy conveyors and the frequent starting and stopping of the charging and pushing machines.

It seems paradoxical to use steam engines in a large gas plant, but the cold business facts of the matter are that, since coke is a by-product and gas a salable commodity at good price, the coal is the cheaper fuel, even with the much poorer economy of steam engines. The plant, as will be noted from the photograph of the façade, is laid out in duplicate about the center-line of the coal and coke bin. At present only one side of it is in use, but when the numerous new stills are completed, now in the masonry stage, there will be only a fair reserve for breakdowns with both sides together. The two main engine-rooms are 75 ft. x 50 ft. and are provided with a hand-power crane, 20 ft. 6 in. above the floor. The building is a structure with steel columns, and curtain walls of buff brick. A very graceful and ornamental finish is obtained by working out a decorative scheme with dentils, pilasters, etc., "rendered" in red brick which contrasts nicely with the buff. The roof, as in all constructions throughout France, is in red tile, with eaves, ridges, etc., in special tile plates—a very neat and pleasing structure and an ornament to the works which it serves.

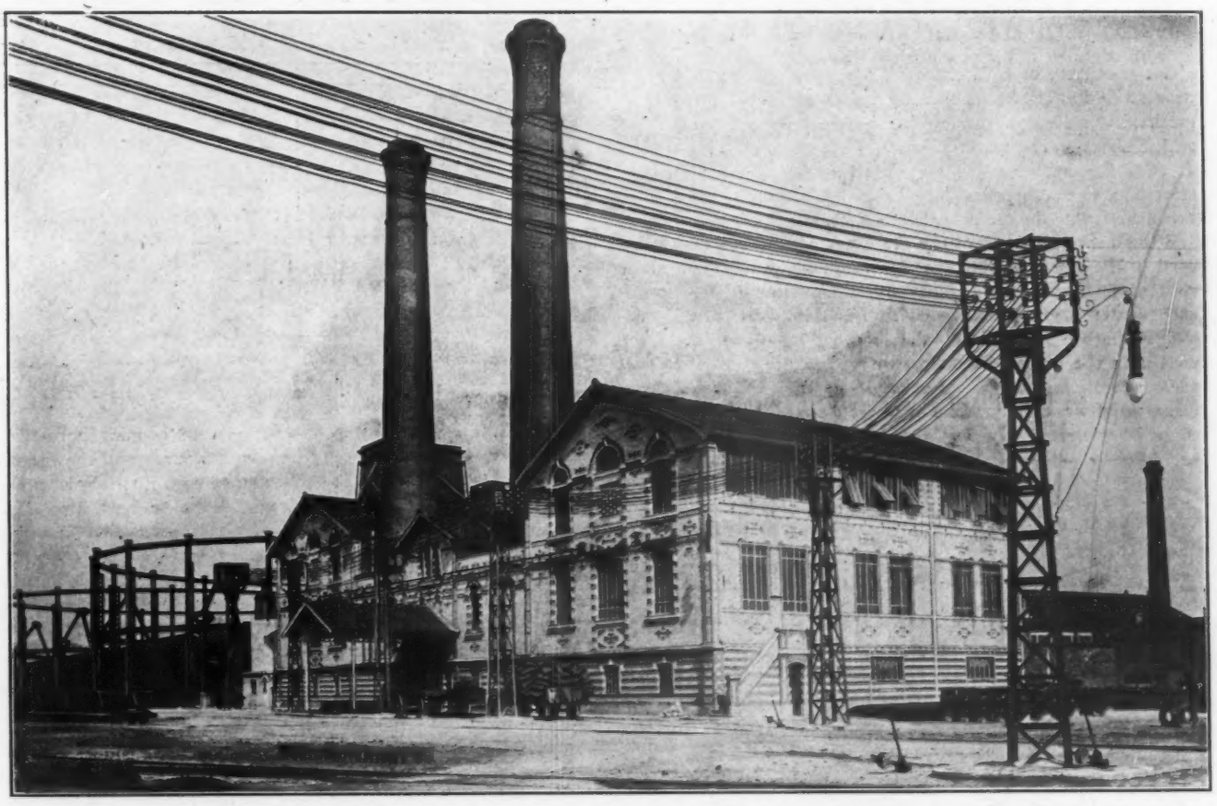


Fig. 1—View of Landy Power House and Distribution Poles.

The fuel used is a mixture of gas-coke and gas-coal, both passed through a pulverizer and grille, so that the grains are

all about the size of hickory nuts, smaller particles and dust being used elsewhere about the works. This is run up by a conveyor into an overhead bin and distributed by down-pipes to the Bennis automatic stokers, made in Bolton, Lancashire, England. The fire is kept about at the density of 20 lb. of combustible per square foot of grate surface, and, as examined by the writer through the peepholes for that purpose, seemed hot throughout and free from dead spots, ash holes and other

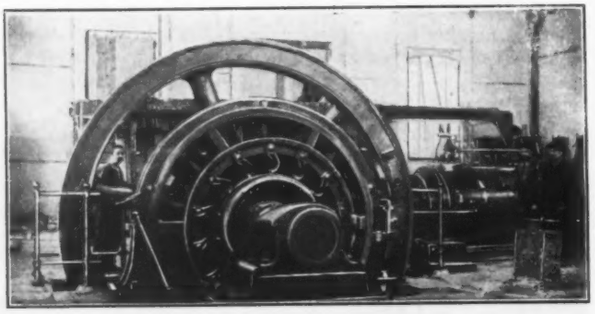


Fig. 2—Assembling Main Dynamos.

troubles inherent in mechanical grates. The grate surface is about 50 sq. ft., or 8 ft. x 6 ft. The Bennis stoker comes the nearest to intelligent hand-firing in its action of any of the mechanical means yet produced, for it actually fires on the coal with a shovel. The main actuating shaft carries a four-lip cam at each fire, which snaps the shovel spring at four different strengths, so that the first jet of coal lands from 1 ft. to 18 in. from the front; the second, 2 ft. to 3 ft.; the third, 3 ft. to 5 ft., and the last to the back of the grate. A cut-off, similar to that used in a gunpowder flask, is also actuated by the main shaft, so that an invariable quantity of combustible is fed to the shovel at each jet. The shovel itself is simply an open V-casting, sliding on a cast-iron table, so that its charge is spread well over the grate. To take care of the ash, the grate bars are made sliding and move slowly forward and backward in groups of four, with a stroke of about 10 in. The length of the grate is calculated to bring the burnt fire and clinkers to the

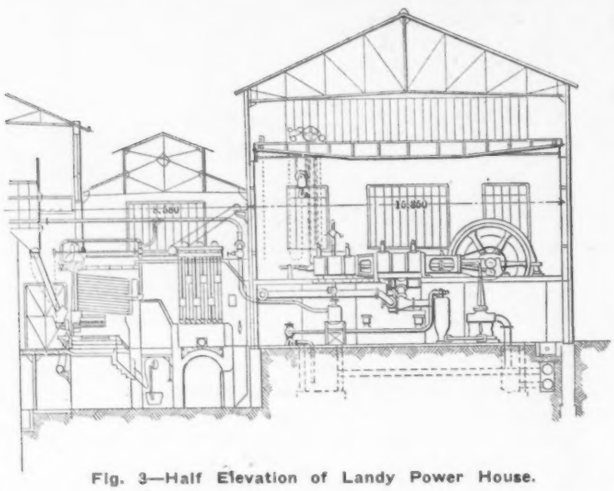


Fig. 3—Half Elevation of Landy Power House.

rear at just about the time they are ready to discard. When any group of bars moves backward fresh coal and fire tumble into the space it leaves at the front. Therefore, when it returns, the fire at the end must stay where it is, and, having no grate under it, falls below into an ash chute where a bucket receives it. The rear of the fire is thus continually and gradually breaking off and falling below into the chute.

There is no bridge wall, but the hot gases strike a deflecting arch which forces them to strike the water tubes at the rear header. The boiler is of the Niclausse make, with a single steam drum at the front and interior steam-collecting tubes passing down inside the water tubes, feedwater being introduced at the back header. The nests of tubes are divided horizontally by omitting three rows of them and substituting the return bends of a row of superheater tubes in their place. A set of baffle tiles is inserted between the two rows of pipes of the superheater, so that the gases sweep over them and reverse at the front header to pass over them again on their way to the back flue. The steam is generated at 200 lb. per square inch and is superheated to 275 deg. C.

After leaving the boiler setting the hot gases traverse the economizers sidewise instead of longitudinally, as is usual in the United States, the tube sections being about 12 tubes wide. This arrangement of the economizer passages simplifies the erection and maintenance very much, for neither "sectional coverings" nor deflectors are needed to allow getting at the tubes, there being plenty of space in the flues on each side of the tubes. The economizers are of the Green type and are built under guarantee. After traversing the economizers the gases pass directly downward along the partition wall between the boiler and engine-room, and enter an arched flue under the economizers, which forms their foundation, and thence to the chimney, which is 130 ft. high by 8 ft. diameter.

The water supply is furnished by a triplex motor-driven

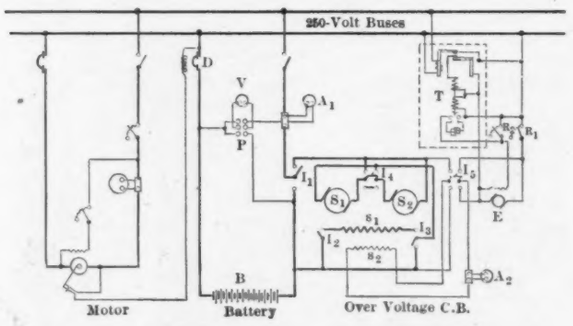


Fig. 4—Wiring Diagram of Charging Dynamo.

pump, with a capacity of 70 gal. per minute, running normally at 190 r.p.m. The motor is 15 hp, shunt wound, and the speed is automatically varied from 490 r.p.m. to 1470 r.p.m. by changing the resistance of the field circuit. Reserve feed supply is assured by injectors on each boiler. It is refreshing to note this cutting out absolutely of the wasteful steam pump from the boiler-house economy. Even if the exhaust of the latter is taken up entirely in the feed-water heater it wastes an untold quantity of steam in the oily drips and the periodic freeings from accumulated condensed steam, etc., all of which is too dirty to risk getting into the boilers. There has been considerable pioneer work done in the United States in substituting the two-stage centrifugal for the steam pump, but the triplex has two advantages not to be passed by: it has a strong and reliable suction, which the centrifugal has not, and it always swings the boiler-feed checks at each stroke, so that the fireman knows beyond doubt whether he is getting water or not by the noise of the checks.

This pump sucks from one of two continuous measuring tanks, which are fitted with a see-saw chute that feeds the water alternately and automatically into either tank, registering each reverse on a counter, so that the consumption of feed-water is always accurately known. One does not find such a complete equipment as this in small plants at home, but its slight additional expense more than pays for it, and it should be a standard feature, even in plants as small as 500 hp.

The steam piping is quite different from what one would find in the United States, American practice being throughout better, safer, and more flexible. The French follow the English usage of brazed copper piping throughout, wherefore the pipes are cut to the smallest practicable size, and all not absolutely essential fittings are eliminated. They have no swing checks on the boiler feed, no automatic stop checks on the main steam pipe,

and the latter is only 4 in. in diameter for 250 hp. Our own practice is an 8-in. pipe for 250-hp boilers, though the steam mains themselves are figured on 4 in. per 250 hp. The advantage of the 8 in. is that it permits the inevitable forcing of the boiler at times without unnecessarily increasing the velocity of the steam in the pipes. The main steam pipe leaves the boiler precisely at the water line, having an interior pipe connected to it and leading up to the top of the steam dome. This pipe carries saturated steam, and leads directly to the superheater, where it is heated to 527 deg. Fahr., and thence it passes to the steam main. It appeared to the writer that here would be essentially the place for wrought-iron pipe, owing to the well-known weakening action of superheated steam on copper and brass pipe; but evidently the danger point in this matter is not reached at 527 deg. Fahr.

Entering the engine-room one perceives what appear to be gas engines at first sight, for the valves are all vertical pop type, driven by cams and a lay shaft, precisely as in our large horizontal gas-engine practice. The writer examined one of the engines in the second engine-room, which was just being assembled. Each cylinder has a cast-iron jacket for superheated steam with inside ports registering with the openings in the valve housings. These are literally sections of the cylinder, about 18 in. in length, the full diameter of the cylinder, and forming with stud bolts its cylinder head. Inside is a pop valve about 10 in. in diameter with a vertical stem extending up through the stuffing box, through the cam and governor trip mechanism, and terminating in a dash-pot above the cam housing. The exhaust valve is similar except that it is a piston valve and does not come down on its seat, and the dash-pot is to one side and operates the valve by a bell crank in the valve bonnet. There are four of these quasi-cylinder heads the full diameter of the high and low-pressure cylinders, and they give a very exact and economical steam distribution and are particularly efficient with superheated steam, but the expense of such a design would put it out of the race against American turbines and Corliss valve engines. The guaranteed steam consumption is 12.5 lb. steam per ihp-hour at all loads from half to full.

The two machines in engine-room No. 1 ran very quietly with no clicking or rattling, such as one hears about a Corliss plant. These machines are tandem compound and were built by Dujardin & Company, Lille, France. The cylinders are 18 in. x 29.5 in. and 36 in. x 29.5 in., and have an expansion ratio of 4 to 1. They are direct-connected to two 400-kw Thomson-Houston, 250-volt, compound-wound dynamos running at 120 r.p.m. A jet condenser in the basement for each engine furnishes a 28-in. vacuum with 1.4 lb. receiver pressure, and each engine has an air pump mechanically driven off the main crank pin by a rock shaft passing below into the basement. This feature of mechanically operating the air pump is quite common in French plants. Just why they do not use a barometric condenser and eliminate the air pump entirely is not apparent.

In one engine-room is located a foundation for an alternating-current motor-generator for use in case alternating current is needed in outlying constructions about the gas plant, and in the other engine-room is a similar foundation on which is installed the motor-generator for charging the storage batteries for the peak load and night service. It consists of a 250-volt, 125-hp motor coupled to a 1200-amp, double-commutator charging dynamo, with a small exciter on the end of its shaft. The field of this little exciter is controlled by a Tirrill regulator, by which the field strength of the main charging dynamo is varied as the charging voltage rises. To get the necessary range of e.m.f. the two commutators are arranged to connect in series or in parallel and the Tirrill regulator takes care of all intermediate voltages. The wiring diagram is shown in Fig. 4.

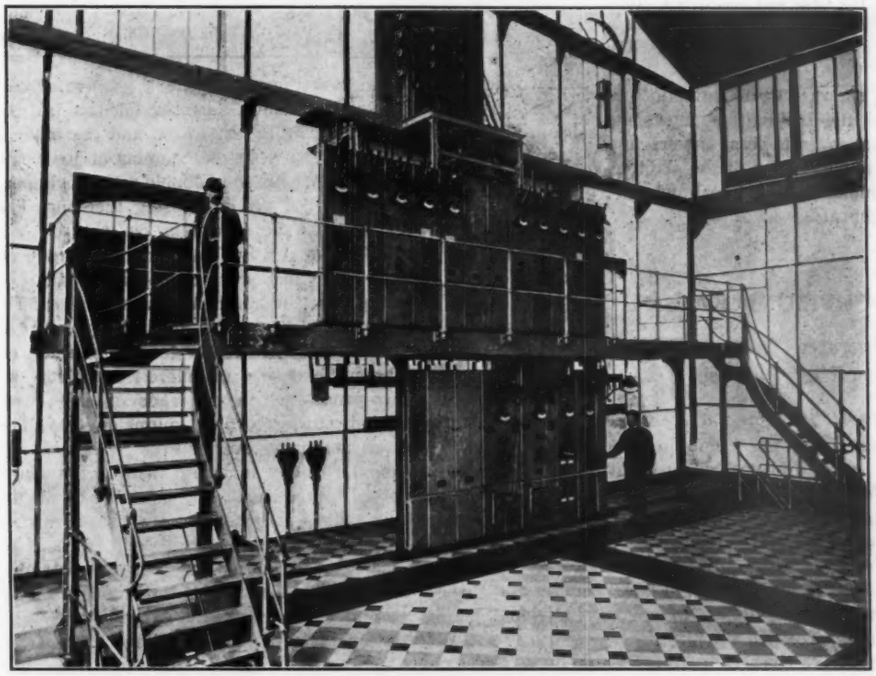


Fig. 5—Main Switchboard.

The storage battery set is arranged on concrete benches in a reinforced concrete, one-story building. The batteries were made by the Tudor Company, 2 volts discharge, voltage per cell, 2700 amp-hours capacity at a 1-hour discharge rate; 3256 amp-hours at a 2-hour rate; 4026 at a 3-hour rate, and 5390 at a 10-hour rate, or roughly 540 kw per hour. On test they gave an amp-hour efficiency of 96 per cent and an energy efficiency of 79 per cent. The arrangements for supply of distilled water to make up for disassociation and evaporation of water were very complete; but for cleaning out sediment no special preparations were in evidence.

The roof of the storage-battery house is shaped to form a great basin sufficiently large to carry two Balke refrigerators rated at 16,000 gal. of cooling water per hour; one is now installed. The basin is divided by bridge walls spaced on about 3-ft. centers, so as to form a scrubbing run for getting out the oil. Only a small quantity of this water is of course used in the boilers, and it is subjected to a further cleaning and softening in the water-softening plant adjoining. This is very much like our early Industrial water-softening equipments, with continuous process, automatic mixing and agitating devices driven by power derived from an overshot waterwheel in the course of the water. It has the usual tall 35-ft. agitating and treating tank, and a settling and filtering concrete tank adjoining.

Returning to the main engine-room, the switchboard consists of six station panels on the main floor and 12 feeder panels in a gallery above. Knife switches are discarded on the main generator panels and reliance placed entirely on the circuit-breaker for throwing in connections. This appears to the author as a very sensible arrangement. Large knife switches are often ruined by attempting to break large currents on them and especially in the hands of nervous operatives they are a real source of danger. On the generator panel is also the usual

field rheostat handle, the ammeter, field switch and watt-hour meter. The only equalizer in sight was that on the panel used for connecting in parallel engine-rooms Nos. 1 and 2, where 3000-amp knife switches were used, being all three independent —positive, negative and equalizer. At the back of the board arrangements for lightning protection were very complete, an arrester and choke coil being on each line. The rheostats operated from below by vertical shafts and bevel gears connected to the rheostat handles. All the positive sides of the circuit were painted heavily with blue oil paint and the negatives red. To avoid tools and electricians being burnt up from inadvertent "shorts" in working back of the board, the writer usually insists on taping all heavy work; but thick paint will give comparative immunity at less expense.

The feeder panels have a single-pole knife switch, a single-pole circuit-breaker, and an ammeter on each panel. Poles of structural steel are used all over the plant. The writer's experience with steel poles has been that one cannot touch anything on them in wet weather without receiving a shock, and that a good chestnut pole, well guyed, will give much more immunity from "grounds," but so far they have not had much trouble with them in this plant. Each one of these lines has a choke coil and lightning arrester mounted on the back of the board.

In general features the plant shows careful attention to proper economies throughout, and the building arrangements for giving light, air, and cleanliness, over boilers, engines and all equipment are admirable. The test efficiency of the plant, as now recorded, runs about 1200 grammes of mixed coal and coke per kw-hour delivered at the switchboard.

ELECTRIC IRRIGATION PUMPING IN KANSAS.

Fourteen Pumping Plants Operated from a Central Station Constructed for That Purpose.

By E. C. Reybold, Jr.

NEAR Deerfield, Kan., not far from the Colorado line, there was installed in the spring of 1909 a system of pumping plants that is unique in that a 375-kw station was installed for the express purpose of furnishing energy to the various pumps, all of which are located upon the lands of the United States Sugar & Land Company. The property comprises about 5000 acres of excellent land in the Arkansas Valley, so located that a transmission line about 15 miles in length reaches all of the pumping plants, each of which supplies water to a 320-acre tract. In this section of the river valley there is an excellent underflow lying at depths varying from 7 ft. to 18 ft. below the surface of the ground. The structure of the

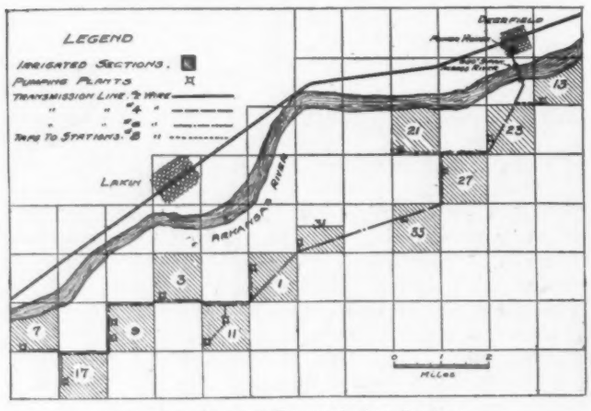


Fig. 1—Map of Transmission System.

land is excellent for a good underflow, consisting, beneath the soil at the surface of the ground, of sand and gravel for a depth ranging as great as 52 ft., at which clay is reached. There is an actual flow of this underground water in the same direction as that of the river itself, and a little toward the stream. The problem in view before the power plant was constructed was that of supplying energy to 14 pumps used to lift the underflow water to the surface, each of which would require from 20 hp to 30 hp, and, although the energy for each might have been supplied by a gasoline engine, it was deemed better to install a single electric station, located upon the railroad of

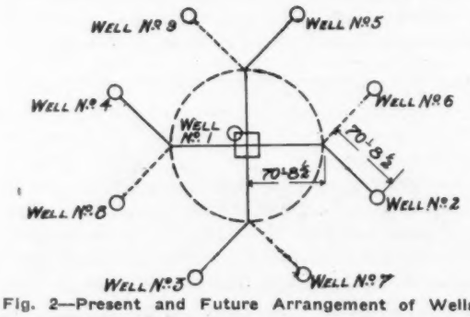


Fig. 2—Present and Future Arrangement of Wells.

ample capacity for all, transmitting the energy to the pump sites.

Two generating units were installed, one a 300-kva, three-phase, 60-cycle, 6600-volt alternator, direct-coupled to a 400-hp producer-gas engine running at 200 r.p.m., and the other a 75-kva machine operating at 450 volts and running at 300 r.p.m. The engine is a twin tandem with four double-acting cylinders supplied from a special type of producer using fuel oil. The average load was 250 kw and the maximum 325 kw. Upon a test run it was found that about 6 kw-hours could be produced per gallon of fuel oil. Three men were employed per shift, or six per day of 24 hours, with the addition of a superintendent. The total cost of labor per 24 hours was about $22.50, and the total cost of energy, after the plant was in good running order, about $0.008 per kw-hour, exclusive of interest and depreciation. There is a two-panel switchboard made of slate, with ammeters, frequency indicator, recording voltmeter, etc. The line is supplied with an automatic overload-release switch.

The pole line is about 15 miles in length, with a few short branches as will be noted by the map. The poles are of Michigan cedar, 30 ft. high with 6-in. tops, and the cross-arms of Oregon fir, 66 in. in length. Porcelain insulators are used to carry the wires, which are of copper, No. 2 for the first few miles and thence Nos. 4 and 6, with No. 8 for branches to the individual motors. With cheap energy a comparatively high line loss was deemed satisfactory, and the voltage drops from 6600 at the plant to about 5800 at the distant end of the line. The lightning arresters are of the multi-gap shunt-and-series type. The operation of these was satisfactory during the season, with repairs limited to a few resistance rods.

There are three 10-kw transformers for each pumping plant,

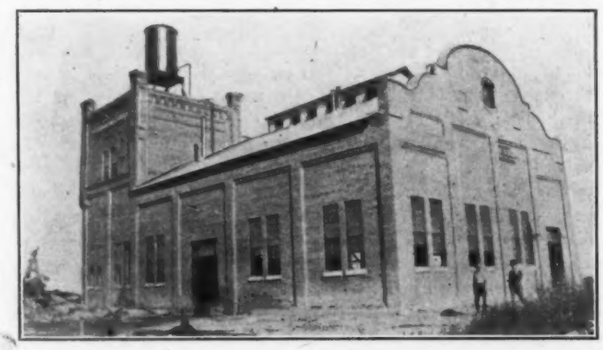


Fig. 3—U. S. Sugar & Land Company's Power Plant.

with primary taps for 6600 volts, 6300 volts, 6000 volts and 5700 volts and a secondary voltage at 450 volts. By making use of the various primary taps the voltage at all of the motors was kept the same regardless of the distance from the power

plant and the main line voltage. The operation of these transformers was also quite satisfactory during the year, and, even though there were heavy lightning storms, none was injured by it.

Each pump is operated by a 30-hp, 440-volt motor, with the exception of one, for which there is a 15-hp motor provided. The motors all run at 1200 r.p.m. and drive the pumps by belts. This arrangement was considered advisable on account of the different heads under which the various pumps were to operate, and also in order that the speed of any pump might be

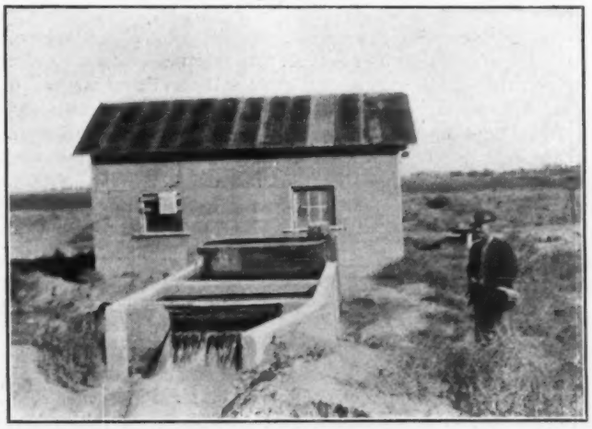


Fig. 4—Pump House.

varied to suit the head against which it must operate after the water level had fallen. If direct-connected units had been used some difficulties might have been encountered. Each motor is protected by an automatic overload and no-voltage release switch.

Each pump is placed in an open well sunk within 2 ft. of the water level, the driving belt running down to it at about a 45 deg. angle below the horizontal from the motor, which is placed at the ground level. The transformers, starting boxes, overload and no-voltage release switches, etc., are all placed in the pump houses, which are of concrete. Each of the 14 pumps is an 8-in. machine, with capacity ranging from 1500 gal. to 2200 gal. per minute in accordance with speed, which varies between 400 r.p.m. and 500 r.p.m. The pump draws water from five

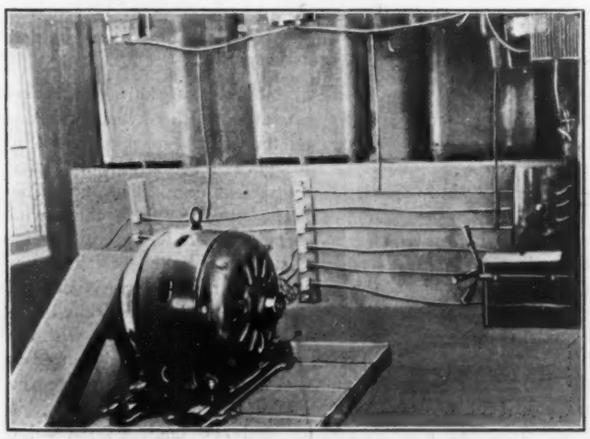


Fig. 5—Electrical Equipment of Pumping Station.

cased walls, one of which is close to the pump, and the other four at a considerable distance from it. It will be noted that the four distant wells in each case are so located as to comprise a portion of complete systems that might contain 13 wells each if it were found necessary at a later date to put down more in order to secure sufficient water. These additional wells have been found unnecessary to date, as the water fell only from 5 ft. to 10 ft. in the casing when the pumps were in operation. The wells are 15 in. in diameter and are constructed of a perforated casing extending to clay, which lies at depths varying to a maximum of 52 ft. The horizontal suction pipes leading from the pumps are made of cast iron, 8 in. in diameter, and the drop pipes leading down into the cased wells are of wrought iron, 6 in. in diameter. Each drop pipe is 28 ft. long. The horizontal pipes were laid in trenches, cut down from the surface of the ground to a point close to the surface of water, at a depth ranging from 7 ft. to 18 ft., following very much the style of laying city water pipes. A suction pump to create a vacuum was used for the first priming, but after that the water contained in the weirs was used to fill the pumps and the whole system of suction pipes, foot valves being used at the ends of the drop pipes to retain the water. Each weir has a capacity of about 280 cu. ft. of water and serves the double purpose of measuring the flow of water and retaining water for priming. The body of the weirs is 6 ft. x 13 ft. x 4 ft. inside measure, made of concrete with 6-in. walls with baffle partitions so arranged as to permit of an even flow of water over the weir proper, which is of the Cipoletti type, with a width of 36 in. The water is discharged constantly over the weir, and it is thus possible for the superintendent to know at each visit just how much water is being discharged by each pump.

Each pump delivers sufficient water for 320 acres of land, and there were about 4200 acres irrigated in 1909. The generating equipment is of ample capacity for four additional pumping plants that are now being installed, and the total area will then be about 5000 acres. The total cost of the installation was about $125,000, or about $25 per acre of land irrigated, which is considerably less than the usual cost of good water rights in gravity ditch and reservoir irrigation systems, many of which cost as much as $60 per acre.

Pumping in 1909 was not started until June 21, continuing thence until Sept. 20. This year it was started early in May. The generating station was operated 12 hours a day during 1909. It is a little difficult to arrive at accurate cost data covering this first year of work. The cost of energy now that the plant is in good working order will probably not exceed 0.008 cent per kw-hour, and the cost of energy per acre-foot of water pumped will scarcely reach $1. The 14 pumping plants were inspected last year by one man, who visited each once a day, and the cost of labor and personal attention was very low, indeed. After the additional pumps are installed this year the system will be complete. It is unique in many ways, and regardless of the haste with which the plant was installed the success obtained during the first season indicates very careful attention to all details of construction, both electrical and hydraulic. Mr. E. B. Neiswanger has supplied the writer with much of the data incorporated in this article.

VARIABLE RATIO CONVERTER.

A variable ratio synchronous converter, which can be connected to feed energy back and forth between alternating-current and direct-current systems or to raise the direct voltage with increasing load independent of the alternating voltage, is the subject of a patent granted to Mr. J. L. Woodbridge. Midway between the field poles are placed small auxiliary poles, which are used to control the e.m.f. generated in the converter. The excitation of the main poles is constant, while that of the auxiliary poles may be controlled by the load on the alternating-current system or that on the direct-current side of the machine. The illustration shows the arrangement for a battery connected to an alternating-current system through an auxiliary-pole converter. A carbon regulator actuated by the load current through a series transformer increases, decreases or reverses the current through the auxiliary windings, thus changing or discharging the battery through the converter according as the load on the alternating-current system is small or great. When used for raising the direct voltage with the load the auxiliary poles are fitted with two windings, one in series with the main field winding and arranged to oppose the second or compounding winding, which is in series with the load circuit.

SINGLE-PHASE COMMUTATOR GENERATOR.—II.

Characteristics of the Asynchronous, Single-Phase, Shunt, Induction Generator, with Self-Excitation.

By Val. A. Fynn.

CONSIDER a stator carrying a two-pole winding S, as shown in Fig. 10, together with a rotor provided with a two-pole commutated winding C and adapted to revolve within the stator. The winding C being short-circuited along an axis approximately coinciding with that of S, for instance,

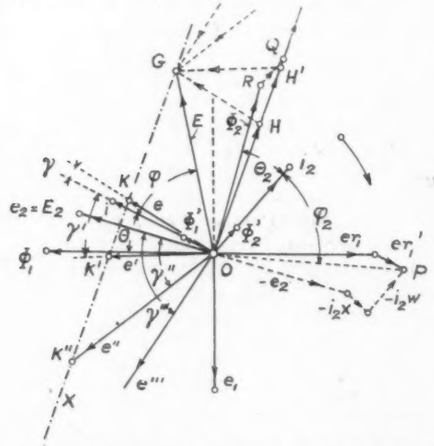


Fig. 7—Complete Time-Phase Diagram of Generator and Locus of Point K for Constant Exciting Flux and Varying Speed. (Reproduced from Part I, May 26.)

by means of a pair of working brushes a_1a_2. Exciting brushes are provided on C, displaced by about 90 deg. from the working brushes. These exciting brushes are connected to a stator winding S' coaxially disposed with S as in Fig. 10 or to a part of S itself, as in Fig. 11. The rotor is driven above a certain critical speed and there is obtained a self-exciting single-phase generator capable of delivering a nearly constant e.m.f. E_2 to a consumption circuit AB, to which may be connected any sort of translating devices such as L.

The periodicity of the actual working e.m.f. E_2 appearing at the terminals of S exactly corresponds to the speed at which the machine is driven only for the case of an ideal generator on open circuit; in commercial machines the periodicity of E_2 is always less than that which corresponds to the speed of the generator and this periodicity diminishes with increasing load

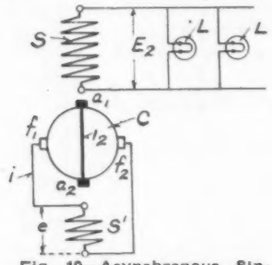


Fig. 10—Asynchronous, Single-Phase, Shunt, Induction Generator, with Self-Excitation.

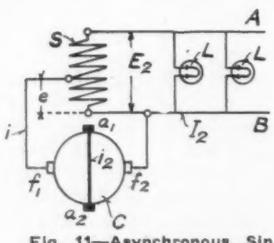


Fig. 11—Asynchronous, Single-Phase, Shunt, Induction Generator, with Self-Excitation.

even if the speed be kept constant. The generator is therefore an asynchronous one and may be operated at any speed above the critical value. The primary working e.m.f. er_1 is generated in C at the brushes a_1a_2 by rotation in an exciting flux, just as in any other generator, and is inductively transferred along the working axis a_1a_2 from C to S, where it appears as the secondary or actual working e.m.f. E_2; this machine is, therefore, an induction generator. The exciting flux Φ_1 appears along the exciting axis f_1f_2. Φ_1 is due partly to the e.m.f. e derived from the stator and partly to an e.m.f. er_2 generated in C by rotation. Since both these e.m.fs. are generated in the machine itself, the latter is referred to as self-excited. Being entirely self-excited, the open circuit characteristic of this dynamo is quite similar to that of a direct-current, self-excited, shunt-wound generator. To obtain a rapid and clear insight into the manner in which this machine operates, it appears best to refer to the asynchronous, single-phase, shunt, induction generator with mixed excitation, which was analyzed by the author in a previous issue.

In Fig. 7 is shown a diagram of the asynchronous, single-phase, shunt, induction generator, with mixed excitation. It has been previously shown for this diagram that point K travels along the line X, receding from G as the speed increases, provided e be so varied as to keep Φ_1 constant. It is, therefore, clear that at a given speed the point K will coincide with the one at which e_2 cuts X. At that moment e will coincide in time-phase with e_2 or E_2. Now E_2 and e of Fig. 11, or e of Fig. 10, are of the same time-phase as e_2 since they are both induced by Φ_2. At the speed for which e coincides in phase with e_2 the independent source from which the e of Fig. 7 is derived can be discarded and that e.m.f. can be taken from S or S' instead, without in the least altering the time-phase diagram shown in Fig. 7. In Fig. 7 e coincides with e_2 at a speed exceeding the synchronous by about 9 per cent. Had the constants of the imaginary machine to which Fig. 7 corresponds been selected in accordance with the best practice this coincidence would have occurred even sooner after exceeding the synchronous speed. Fig. 12, derived from Fig. 7, represents the conditions when e is cophasal with e_2, and, therefore, correctly depicts the no-load conditions in the self-excited generator. Fig. 12 is a complete time-phase diagram fully taking account of the various leakage fluxes and of their static and dynamic effects.

If the periodicity of E_2 or e be taken as a basis of comparison, as was done in the case of the generator with mixed excitation, then Fig. 12 may be said to correspond to a self-

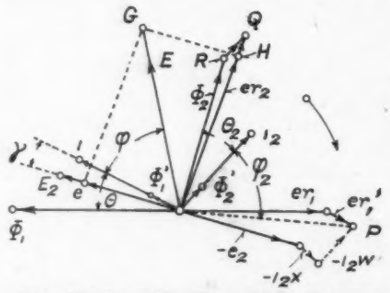


Fig. 12—Complete Time-Phase Diagram of the Asynchronous Generator with Self-Excitation.

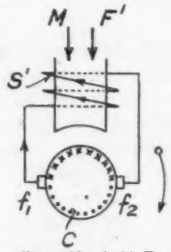


Fig. 13—Self-Excited Direct-Current Shunt-Wound Generator.

excited generator running a little above synchronism. Viewing the no-load condition of a generator of this type from this standpoint justifies the statement that such a machine will tend toward its synchronous speed and will actually run at that speed, at no-load, provided the generator is an ideal one. This viewpoint is a proper one for the case of the machine with mixed excitation where the periodicity of E_2 is entirely independent of the speed and depends only on the periodicity of that component e of the exciting e.m.f. E which is derived from an outside source. For the case of the self-excited machine it is more appropriate to take the speed together with the number of poles as the basis of comparison, since the speed is determined by the prime mover and the load and since the periodicity of the generated e.m.f. is the true variable in this case, increasing with decreasing load and tending to a value corresponding to that of the speed at which the machine happens to be driven. Looking at Fig. 12 from this more correct point of view it must be said that the frequency of the working e.m.f. in that figure is about 9 per cent below the ideal frequency or that which corresponds to the product of the number of poles and the speed.

In Fig. 9 was shown the effect of a load on a generator with mixed excitation. The point to note is that δ or the time-phase difference between i and E_2 increases with increasing load so

as to cause E_2 to lag more and more behind i or, which is the same thing, so as to cause i to lead E_2 more and more. In the case of a self-excited generator, e is inseparably bound to E_2 and will consequently follow E_2 as the latter increases its lead on i with increasing load. In other words, the time-phase angle γ between i and e is always negative under no-load conditions in the case of the self-excited generator and increases in value as the load increases. It is known from Fig. 7 that an increase of the negative γ corresponds to a rise in speed in the case of a generator with mixed excitation. In the case of a self-excited generator the speed is fixed, but the frequency of E_2 is not. The frequency of E_2 must therefore diminish with increasing load in order to satisfy the diagram shown in Fig. 7 for the case where e is cophasal with E_2 and is kept cophasal with E_2 throughout the operation of the machine.

It is of considerable interest to ascertain just how the process of self-excitation is initiated. Fig. 13 shows an ordinary direct-current, self-excited, shunt generator. If the arrow M indicates the direction of the remnant magnetism and the commuted winding C is rotated clockwise, then the e.m.f. generated in C will be distributed as indicated by the crosses and dots within the circle representing the commuted winding. This e.m.f. causes a current from C to f_1 through S' and back to C by way of f_2. If S' is so connected that this current produces a flux F' of the same direction as M then the machine will build up. If the direction of M is reversed the machine will nevertheless build up, but the e.m.f. generated in the rotor will be of opposite direction. In this simple manner is obtained a unidirectional e.m.f. of any value with the help of rotation and of small remnant magnetism. An important point to keep in mind is that the direction of this e.m.f. depends on the direction of the remnant magnetism. These same phenomena also

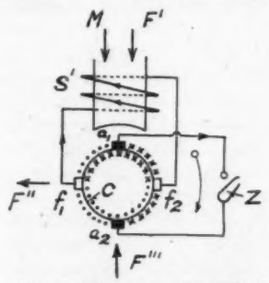


Fig. 14—Manner in which the Unidirectional E.M.F. Generated in Fig. 13 is Converted into an Alternating E.M.F. of Rapidly Increasing Frequency.

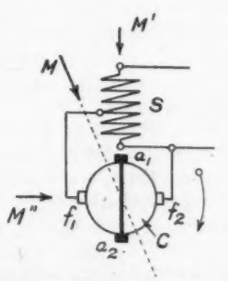


Fig. 15—Picking Up Process for the Case of a Field Structure Without Defined Polar Projections.

give the initial impulse by means of which an alternating e.m.f. can be obtained instead of a unidirectional one.

Consider Fig. 14 and assume the switch Z to be open. The conditions described in reference to Fig. 13 will of course again obtain as soon as a sufficient speed has been reached. The exciting current circulating through C (from f_2 to f_1) produces a flux F'' directed as shown in the figure. By rotation in this flux another e.m.f. is generated in C; its maximum value appears between the brushes a_1a_2; its distribution is shown by dots and crosses placed outside C. If Z be now closed then a current will flow from a_1 to a_2 and will produce a magnetization opposed to that produced by S'. If C has many turns as compared to S' then F'' will be greater than F' and the flux F''' due to the current in C from a_1 to a_2 will, of course, also be greater than F'. Under these conditions F''' will overpower F'. As soon as Z is closed the flux F''' will annul F' and will reverse the direction of the remnant magnetism M.

As the resultant flux in the axis a_1a_2 diminishes, becomes zero, and reverses, so does the e.m.f. at the brushes f_1f_2 diminish, become zero and reverse. F'' follows the variations of this e.m.f. and F''', which depends on F'', necessarily dies down immediately after having reversed the remnant magnetism M in the axis a_1a_2. The cycle now begins over again, all e.m.fs. and fluxes being, however, reversed; keeping Z closed does not alter the sequence of events. The higher the speed, the quicker the picking up process and the more rapid the reversal of the remnant magnetism; moreover, the greater the value to which the remnant magnetism is reversed by F'''. This is evidently a cumulative process and the reversals become more and more rapid; in other words, the frequency of all the e.m.fs., currents and fluxes increases rapidly. The periodicity of the flux in the axis a_1a_2 is the one which determines the periodicity of E_2 of Fig. 10 or 11 and this periodicity, of course, rises with the rest.

A state of equilibrium will be reached in the case of an ideal machine when the induced e.m.f. in each axis exactly equals and opposes the generated e.m.f. in that axis. The magnitude of the generated e.m.f. depends on the speed and on the magnitude of the responsible flux. The magnitude of the induced e.m.f. depends on the periodicity and on the magnitude of the responsible flux. Now the speed depends only on the prime mover and may be taken as constant, but it has been shown that the frequency and the magnitude of the fluxes tend to increase very rapidly and they will therefore increase until the equality defined above is reached. This equality will be reached in the case of an ideal, asynchronous, single-phase, shunt, induction generator with self-excitation when the frequency of the terminal or working e.m.f., E_2, is the same as the frequency of rotation—that is, the frequency determined by the number of poles of the machine and the number of its revolutions per second. If the frequency of E_2 were to exceed that of rotation then equilibrium could only be maintained by feeding energy from the mains into the generator. If the generator is not an ideal one then the state of equilibrium will be reached when the frequency of E_2 is a little below that of rotation, the generator then supplying its own losses. If more energy is required from such a generator, be it to cover increased losses in the machine itself or for any other purpose, then the frequency of E_2 will diminish still further.

In Fig. 15 the exciting brushes are connected to a part of the winding S which is supposed to be located on a field structure without defined polar projections, generally known as a stator, and the brushes a_1a_2 are permanently short-circuited. This figure, therefore, depicts the actual conditions existing in practice. The remnant magnetism in such a structure may at first be anywhere. Let it be, for instance, directed as shown by the arrow M; then M can be divided into two components, the one M' coinciding with a_1a_2 and determining the direction of the e.m.f. at first generated at the brushes f_1f_2 and the other M'' coinciding in direction with f_1f_2 and determining the direction of the e.m.f. first generated at the brushes a_1a_2. In Fig. 15 M has accidentally been so chosen that the ampere-turns of C in the axis a_1a_2 at first assist those of S. The C ampere-turns must, however, be rapidly reversed because the current through C in the direction f_1f_2 tends to produce a flux F'' opposed to M'' and soon overpowers the latter. As soon as this occurs then the ampere-turns along a_1a_2 quickly overpower those of S, reverse the direction of the remnant magnetism M and thus initiate the cumulative process already fully described in connection with Figs. 13 and 14. Machines of this kind do not excite very readily, because the laminated structure of the magnetic circuit retains little magnetism and because the flux F''' can reverse and increase the remnant magnetism only at comparatively high speeds. The building up process can be accelerated by interrupting the short-circuit between a_1 and a_2 until the machine has built up as a direct-current generator. Such machines will not build up an alternating e.m.f. if the turns of S, which are connected to the exciting brushes, are equal to or exceed the turns of C, because then the ampere-turns of C along a_1a_2 cannot possibly reverse those of S at any speed. The turns of S connected to f_1f_2 must be considerably less than those of C in order to secure reliable and rapid picking up; on the other hand, if the turns in that part of S are too few they will not produce a sufficiently large flux F' along a_1a_2. Since the frequency of rotation of such machines always exceeds the frequency of the working e.m.f. generated by them they can be provided with a squirrel-cage, in which event the short-circuited brushes a_1a_2 can be dispensed with.

INDUCTION MOTOR.

A patent issued to Mr. R. B. Williamson on April 5 pertains to a rotor winding so arranged that groups of coils may be connected with a number in series when starting and each short-circuited when running at full speed. This arrangement permits the variation of the resistance of the secondary circuit without the use of a resistor.

HIGH-SPEED DIRECT-CURRENT MACHINE.

In large direct-current generators designed for high-speed operation the induced voltage between the terminals of a single coil, even if the coil has only a single turn, may be too high to impress on adjacent commutator segments if good commutation is to be obtained. It has been proposed to provide twice as many segments as armature coils; to connect only alternate segments to the armature winding in the usual way; and to connect the remaining segments to the opposite ends of the coils by conductors running through or under the armature core. By means of this arrangement the voltage between adjacent commutator segments is reduced to one-half that of a single turn of the armature winding, but commutation difficulties are introduced by the fact that the current is shifted alternately from one end to the other of the armature coils, and that the leads which carry the current to the back end of the armature possesses very high self induction, because of their location in or under the armature core. This self induction gives rise to high reactive voltages which interfere with proper commutation.

Mr. E. F. W. Alexanderson has recently obtained a patent in which the commutation troubles incidental to the use of leads through the body of the armature core are reduced to a minimum. A plurality of armature windings are connected to successive commutator segments, and connections are made from each end of each coil of each winding to the opposite end of a coil of another winding at the same potential. These connections are placed in pairs in or beneath the armature core without introducing any detrimental self-induction, because, as the current varies in one of these connections, an equal and opposite variation occurs in an adjacent connection, which neutralizes the inductive effect of the current variation in the first connection.

SINGLE-PHASE COMMUTATOR MOTOR.

The speed-torque characteristic of an alternating-current motor having a series characteristic, such as the compensated series motor, or the repulsion motor, or a combination of the two, differs from that of a direct-current motor in that the torque falls off less rapidly with increase of speed. The result is that if in an alternating-current locomotive the motors are designed with a high enough torque to drive the maximum load on the locomotive, the locomotive will tend to run away on light loads. This tendency can be eliminated by superposing on the series characteristic of the motor a shunt characteristic which limits the speed.

In a patent issued to Mr. E. F. W. Alexanderson, on March 29, this shunt characteristic is attained by using a phase converter having one phase connected to a source of voltage substantially in phase with the line-voltage, or with the voltage across the inducing or compensating winding, and another phase connected to the exciting winding. Such an arrangement impresses a shunt excitation of proper phase on the exciting winding, which, because of the leakage in a phase converter of ordinary design, is not absolutely fixed, so that the effect is merely to superpose a shunt characteristic on the series characteristic of the motor.

The phase converter may be connected with one phase across the line, or that phase may be derived from an auxiliary winding on the stator in inductive relation to the inducing winding. Furthermore, the leakage field between this auxiliary winding and the inducing or compensating winding may be so placed as to benefit commutation by neutralizing the e.m.f. generated by the exciting flux in the coils short circuited by the brushes.

It is suggested that in locomotives which employ forced ventilation, use could be made of a polyphase induction motor for driving the blower and that this induction motor could also serve as phase converter. Polyphase e.m.f. for starting the induction motor is derived from the commutator motor. The illustration shows a diagrammatic connection in which an auxiliary winding *G* is used.

Another patent issued on March 8 to Mr. Alexanderson covers improvements in this type of motor, which are intended to minimize the commutation reactance. If when the shunt voltage is impressed on the armature, the exciting winding is in circuit with the inducing winding, the armature ampere-turns are in excess of the ampere-turns of the inducing winding, so that leakage fields are produced, and these leakage fields, when cut by the short-circuited armature coils, induce in them an electromotive force which assists the electromotive force of commutation reactance and increases its injurious effect on commutation. If the exciting winding is connected in circuit with the armature, instead of with the inducing winding, the leakage fields produced are in the proper direction for producing an electromotive force opposing that of commutation reactance, so that the commutation is improved, but the amount of these leakage fields produced by the exciting winding in the armature circuit is not always great enough wholly to neutralize the effect of commutation reactance.

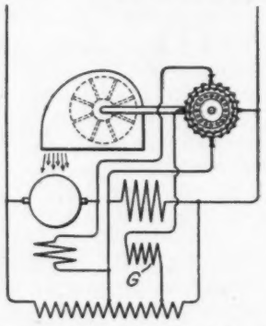


Fig. 1—Single-phase Commutator Motor.

The method covered by the patent consists in arranging the inducing or compensating winding so as to produce excessive flux at the pole tips. With this arrangement, the total ampere-turns of the armature, which are uniformly distributed, may exceed those of the inducing winding and yet the inducing winding is stronger at the pole tips where commutation occurs.

STARTING SINGLE-PHASE COMMUTATOR MOTORS.

In a patent issued to Mr. Geo. T. Hill, a method of improving the starting torque of alternating-current motors, both of the series and repulsion type, is set forth. Mr. Hill points out that the current produced in the armature coils short-circuited by the brushes, in addition to causing sparking also reduces the starting torque by shifting the field flux out of phase with the field current and since the field current and armature currents are approximately in phase, the field flux is also shifted out of phase with the armature current. The invention covers a means proposed to keep the field flux and armature current in time phase. At starting, before the compensating winding becomes effective, the armature current is approximately 90 time-degrees behind its impressed e.m.f., and therefore the field winding may be excited by impressing across it an e.m.f. in phase with that across the armature and the field flux will always be 90 time-degrees behind the e.m.f. impressed across the field winding regardless of the value of the short-circuit currents in the armature winding. This condition is attained by impressing across the field winding a fixed value of e.m.f. in phase with the e.m.f. across the armature, and when the motor is in motion the short-circuit currents are

cut down and the regular running connections either series or repulsion restored. Fig. 1 shows the connections as applied to two compensated series motors.

The effect of the connection covered by Mr. Hill's patent is only momentary and decreases from the instant the motor

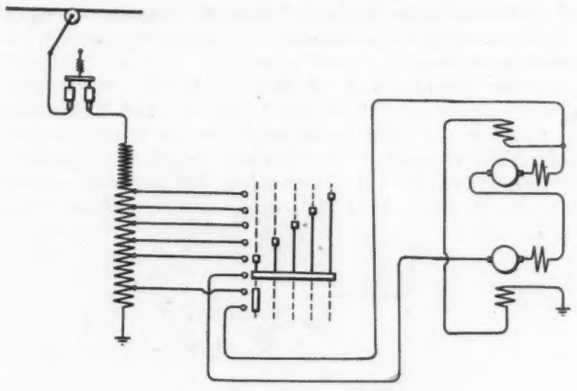
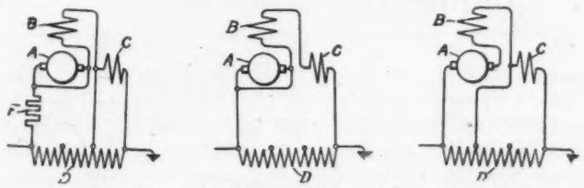


Fig. 1—Hill Motor Control.

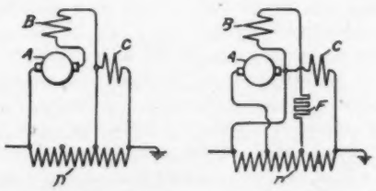
begins to move. In a patent issued to Mr. E. F. W. Alexanderson the initial effect attained by impressing a constant e.m.f. across the field winding is extended slightly by connecting a resistor in series with the field winding and thus making the e.m.f. across field winding lead the e.m.f. across the armature. The steps in starting a single-phase commutator motor are shown in Figs. 2, 3, 4 and 5. At the initial instant (Fig. 2) the e.m.f. across the exciting winding *B* slightly leads that



Figs. 2, 3 and 4—Alexanderson Motor Control.

across the inducing winding *C*, due to the non-inductive resistance *F*, but as soon as the motor begins to move the counter e.m.f. in the armature shifts the phase of the currents in the armature and the inducing windings so as to bring them first into phase and then taken into a leading time-phase position with reference to the field flux. By properly choosing the resistance *F* the motor will reach an appreciable speed before the controller need be turned to the next step, which is shown in Fig. 3.

The second step is the ordinary repulsion motor connection



Figs. 5 and 6—Alexanderson Motor Control.

and is well adapted to low-speed running. At the third step (Fig. 4) the exciting winding *B* is connected into the armature circuit and includes a certain value of external e.m.f. which is intended to cut down the inducing flux which is excessive at high speeds. The object of connecting the exciting winding into the circuit is to neutralize the commutation reactance by introducing leakage fields. The last step (Fig. 5) consists in further increasing the value of the external e.m.f. introduced into the armature circuit.

Fig. 6 shows a method of connection which may be substituted for that shown in Fig. 2. An external e.m.f. is inserted in the armature circuit of such phase as to assist the inducing winding and increase the inducing flux, thus improving commutation at low speeds.

INSULATION OF HIGH-TENSION CIRCUITS.

A tripping device for use in connection with oil switches in high-tension circuits is described in a patent issued to Mr. J. N. Kelman. The device itself is covered by a patent filed in 1907, while the present patent covers the construction of the insulators. Referring to Fig. 1, the incoming transmission line is led to a solenoid wound upon a special insulator, inside of

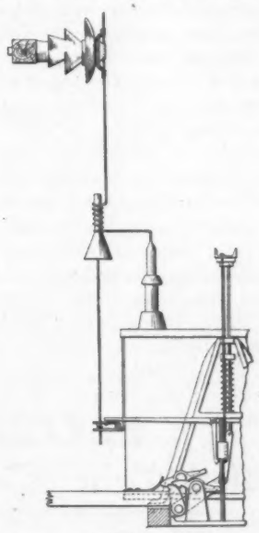


Fig. 1—High-Tension Circuit-Breaker.

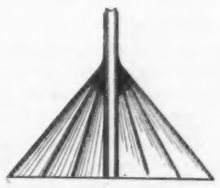


Fig. 2—Laminated Insulator.

which is located a soft iron core connecting with the tripping device in the switch. The insulator is made up of laminations of soft fabric such as cambric interspersed and impregnated with insulating varnish. Insulators of this type of construction may be made in any desired shape by winding the fabric over a rigid form, applying the varnish between layers and then removing the form when the mass has dried. Petticoat insulators

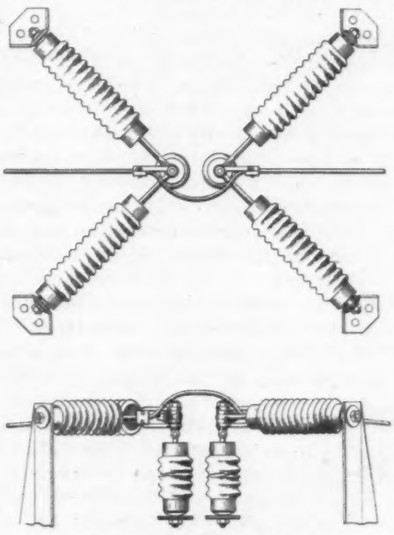


Fig. 3—Mershon Insulator.

of this type are made up of a number of laminated petticoats held together by masses of insulating varnish poured in to fill the space between the petticoats.

INSULATOR FOR WITHSTANDING HEAVY STRESSES.

A type of insulating support covered by a patent issued to

Mr. Ralph D. Marshon is made up of tubular members so disposed as to resolve all forces sustained by the porcelain into tension and compression, and in certain cases the tension is entirely eliminated. Fig. 3 shows an insulator of the latter type. This form of insulating support appears to have a number of signal advantages, electrical as well as mechanical. It is well known that the compressive strength of porcelain, which is about 15,000 lb. per sq. in., greatly exceeds its tensile as well as its shearing strength, therefore any means of utilizing the porcelain, which will eliminate all stresses but compression, will greatly reduce the amount of material required to attain a given strength. The form of the insulator is such as to resist electrical breakdown in an efficient manner. The arcing and distances are directly proportional to the weight of porcelain used, therefore the cost for very high tension supports should not be excessive. Insulators of this type will be cleaned by wind and rain, and offer no crevices for the harboring of insects and dirt. When a flash over occurs it will be less liable to shatter this type of insulator than the petticoat type. Taking all the mechanical and electrical advantages together, they appear to make a happy combination for economical use of material in the production of a reliable support for transmission conductors.

INSULATOR FOR EQUALIZING ELECTROSTATIC STRAINS.

The electrostatic strain exerted upon the porcelain in the immediate neighborhood of the conductor is greatly reduced by increasing the distance of the conductor from the pin. Mr. W. T. Stoddard recently obtained a patent in which this end was accomplished by mounting the insulator horizontally and placing a porcelain ring around the head, as shown in Fig. 4. The line wire is laid over this ring and wrapped with one turn of a tie wire champed at two points equal distance from end at

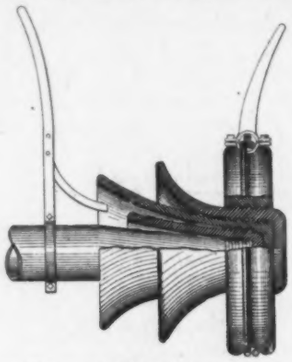


Fig. 4—Goddard Insulator.

opposite sides from the insulator. The insulator shown is equipped with a protective device intended to dispose of arcs without shattering the insulator. This feature is not claimed in this patent, but is covered in a patent filed about a year later.

Central Station

Management, Policies and Commercial Methods

ELECTRIC IRONS IN LONDON.

The Electric Supply Publicity Committee of London and District, which is engaged in a campaign of publicity as to the advantages of electric lighting, is now turning its attention to electric ironing. It has issued a poster, 40 in. x 25 in., in five colors and a showcard, 15 in. x 20 in., of similar design and coloring illustrating electric ironing. It also issues a tastefully colored post-card with the same object in view.

FARMERS' LIGHT AND POWER SERVICE AT FARGO, N. D.

The Union Light, Heat & Power Company, of Fargo, N. D., is extending its lines for 1.5 miles outside of the city limits to the County Hospital, and the farmers along the way are showing an eagerness to obtain service both for lighting and for operating farm machinery. Four applications have already been received. The Union Light, Heat & Power Company, which was recently taken over by H. M. Byllesby & Company, of Chicago, will make a thorough investigation of the feasibility of serving farmers in the country tributary to Fargo, and some interesting experiments may result.

DAYTON (O.), CENTRAL-STATION BOOKLETS.

The Dayton Lighting Company, of Dayton, Ohio, has published two interesting booklets entitled "Rules and Regulations Regarding Electric Service Supplied by the Dayton Lighting Company" and "Meter Department Regulations." The former is issued primarily to acquaint architects, engineers, contractors and others planning or installing apparatus or equipments intended to be connected to this company's distributing system, with the regulations of the company governing the connections of services, various voltages and kinds of supply, meters and wiring, etc.; also information regarding the proper selection of motors to be operated from the company's mains. The territory covered by the direct and alternating systems is shown by maps supplied on request. It is stated that in commercial work all installations comprising more than two circuits, and in residence work installations comprising more than three circuits, must be three-wire. All mains, whether two or three-wire must be designed to deliver the maximum load at the center of distribution with a loss not to exceed 2 per cent. It is suggested and recommended that architects and contractors while planning or installing a system of residence lighting should not overlook the growing demand for cooking and heating appliances and that they make such suggestions to the prospective customers. Special outlets should be provided in buildings and baseboards for the convenient connection of these appliances in the various rooms. Service wires must be carried out of the buildings in iron conduit at least 15 ft. from the ground; they must not be smaller than No. 12 B. & S. At least 3 ft. of wire must extend from the conduit, which must be equipped with approved weatherproof fittings.

Each meter must be protected by a fused knife switch installed on the service side of the meter so as to protect the meter as well as the circuit beyond. All service wires between the point of connection with the company's service and the meters must be installed in iron conduit, except on an open-wiring job, where the meter location is within 5 ft. from the service entrance switch and there are no intervening walls or partitions. Meters will not be installed in bathrooms, toilet-rooms or any part of a building usually kept locked, nor in restaurant kitchens when it is possible to place them elsewhere. The meter board is to be of neat design, made of clear, straight-grained poplar or white pine properly filled with moisture-repelling paint and securely fastened to the wall.

The booklet is given to architects and contractors, the recipient signing a receipt and agreeing to familiarize himself with the contents.

The booklet entitled "Meter Department Regulations" is for the purpose of acquainting employes, and especially those in the meter department, with methods that the company considers

the best for conducting this branch of the work. The work of the meter department is divided into three general operations: (a) installation, (b) inspection, (c) testing.

Meter tests on consumers' premises must be made under three conditions of load. First, 5 per cent of the connected load; second, normal load; third, maximum load. Accuracy must be within 5 per cent. Three tests are to be made at each load, the average of the three determining the conditions. Testers must note the general conditions of installation and report to the department things that need attention and also check the company's record of consumers' connected load.

Except for motors operating under special conditions the following schedule as to frequency of testing is prescribed: Residence meters, induction type, every 24 months; residence meters, commutator type, every 12 months; commercial lighting meters, 25 amp and under, every 12 months; commercial lighting meters above 25 amp, every 6 months; power meters, all types, 25 amp and under, every 12 months; power meters, commutator type above 25 amp, every 6 months; power meters, induction type above 25 amp, every 12 months.

The instruments to be used in regular testing are specified as a stop watch, rotating standard, voltmeter, milli-voltmeter with shunt for current reading, artificial load, portable storage battery and indicating wattmeter.

For testing alternating-current single and polyphase meters from 25 amp to 100 amp, the stop-watch and indicating wattmeter are specified. For single and polyphase alternating-current meters the rotating standard is specified. For testing direct-current meters of less than 25-amp capacity the stop-watch and milli-voltmeter with artificial load are specified. For direct-current meters of 25 amp to 100 amp capacity the stop-watch, milli-voltmeter and portable storage battery are specified. Tests not coming under those named are to be the subject of special testing instructions given by the head of the meter department.

ANNUAL REPORT OF THE MARQUETTE (MICH.) CENTRAL STATION.

An article was printed in these columns in the issue of Feb. 11, 1909, descriptive of the unusual results obtained in the operation of the municipal electric light and power plant at Marquette, Mich. The causes for the unusual success attained there were also analyzed. The report of the electric light and power commission of Marquette for the year ending March 8, 1910, has recently been issued, and shows a continuation of the policy which has been pursued for a number of years past in the management of this plant.

The city is especially fortunate in owning a water-power but a short distance from the city which has been developed at a comparatively low expense. No steam reserve is maintained, as the water-power is sufficient to carry the load at all times, except in cases of unusual breakdown. The growth of the business and the surplus earnings of the year seemed to the commission to warrant a reduction of rates, and accordingly the rates for the street arc lamps paid by the city to the light and power commission have now been reduced from $6.25 to $5 per month, and the residence lighting rate from 7 cents to 6 cents per kw-hour.

The report shows $10,406.78 expended on new construction. The operating expense, including all repairs and renewals, was $25,390.78. The interest paid was $2,335. Bonds amounting to $24,000 were paid off during the year. The commission is now lighting 1420 residences and 392 business places. The gross income from the operation of the plant was $60,337.23. The gross income from the wiring done for consumers, which is classified under the Marquette accounts as "shop," was $25,682.54.

Of the operating expenses, the total manufacturing expense, usually known as generating expense, including repairs on dams, water-wheels, etc., and all of the labor and supplies used at the power house, amounted to $12,349.74. The total distribution expenses, including repairs and renewals of lines, trimming and care of lamps, free decorative lighting of streets, meter reading, testing and repairs and other items pertaining to distribution, amounted to $9,072.19. The office and miscellaneous general expense was $3,968.85. The total operating expense was, therefore, $25,390.78. Deducting this from the $60,337.23 gross income from electric service gives net earnings of $34,946.45. Out of this net revenue the interest on bonds and the principal of bonds before mentioned were paid.

The commission in its report furnishes an estimate of the actual surplus earned by the plant over and above depreciation on the investment. In making this estimate on depreciation the commission evidently figures very conservatively on the safe side, quite in contrast with many estimates of this kind. In its estimate on depreciation no credit is apparently given the plant for the bonds which have been paid off. In other words, instead of figuring depreciation simply on the bonded indebtedness or liabilities of the plant, the commission takes depreciation on the total investment which has been made in the plant since it began operations in July, 1889. In so far as this total investment has been made from profits made from the operation invested in permanent improvements and not represented by any bond issue, this depreciation should, of course, be figured. As the light and power commission is independent of other city funds and is paid by the city for service, just as if it were a private company, the commission has had no opportunity to make investments out of general taxes.

That portion of the investment which is represented by bonds which have been paid off from the net earnings would not in strict accuracy have to be included in the investment upon which depreciation is figured. The indebtedness of the light and power commission at the end of the year was only $41,453.62, of which $34,500 was funded indebtedness in the shape of bonds. The total amount invested in the plant since it started in 1889 is shown to be $238,276.16. The disbursements for generating and distributing current, office and miscellaneous expenses, interest, payment of bonds and a loan of $5,602.84 to the city of Marquette aggregated $483,364.09. The operating expenses included in the foregoing include items of loss and displacement, amounting to $34,154.85.

In the commission's estimate on depreciation, the depreciation on buildings is taken as 5 per cent, power plant 5 per cent, poles and pole fixtures 8 per cent, transmission 2 per cent, teams 10 per cent, dynamos 10 per cent, copper conductors 3 per cent, arc lamps 10 per cent, transformers 10 per cent, meters 10 per cent, motors 10 per cent. On items which cannot be separated between the street lamps and commercial service, depreciation is divided according to the relative earnings of the two kinds of service. Where the investment can be separated, depreciation is estimated on the actual investment.

The depreciation on the street-lighting service apparatus aggregates $1,833.39 and on the commercial service $12,799.17. Adding operating expenses, depreciation and sinking fund together gives $7,067.52 for street service and $36,735.82 for commercial service. Deducting these from the gross earnings of these two services gives the commission a profit of $2,559.94 on street lighting and $13,973.95 on commercial light and power business. The light and power commission carries on a wiring business for consumers and the gross receipts from this source were $38,418.19 during the year. The expenses were $36,265.86, leaving a net profit of $2,152.23.

The capacity of the power plant is 850 kw. The city has 82 motors installed and connected on its line. There are 918 electric flatirons. The peak load on the plant is 870 kw. The kw-hours sold were 1,622,970. Adding to this 21,270 used by the plant and offices gives the total accounted for energy as 1,644,240. The total energy generated was 2,269,000. The percentage sold and accounted for is, therefore, 72.6 per cent. The operating expenses amount to 1.55 cents per kw-hour sold. This is divided as follows: Generating expense, 0.76 cent; distributing expense, 0.55 cent; office and miscellaneous general ex-

penses, 0.24 cent. The average price per kw-hour received for energy sold was 3.7 cents.

The unusual showing and complete records of this plant, which are in striking contrast to many municipal plants, is brought about partly by the favorable natural conditions of cheap water-power and partially by the very efficient management of the light and power commission, whose chairman, Mr. J. E. Sherman, gives much personal attention to the business management of the plant, and is ably seconded by Mr. Charles Retallic, who has been superintendent for many years. Without the continuous management given to this plant by these gentlemen, who have been able to operate it very much as if it were a private enterprise, and without the cheap water-power available, no such success could have been recorded.

MOTOR-SERVICE INVESTIGATION IN A BRICK PLANT.

One of the most attractive loads which can be secured by a central station seeking to expand its summer motor-service business is that furnished by a first-class brick-making establishment. The demands for service in this industry are large and well sustained throughout the entire working period, which covers a portion of the year when there is usually a considerable amount of generating equipment unutilized, on account of the absence of the lighting load, which rises to so much greater values during the fall and winter months. In the following paragraphs are given the engineering details of a recent successful campaign to secure the business of a brick company near Providence, R. I., the central station handling the work being the Narragansett Electric Lighting Company. In this instance the engineers of the Narragansett company followed their usual practice of taking indicator cards from the engines in the original steam-driven installation and submitting a complete report upon the comparative cost of electric and steam drive, including fixed charges.

The object of the investigation was to determine the comparative cost of the former steam-engine service with Narragansett electric service. The brick plant consisted of two installations in the immediate vicinity of one another. The first plant had a steam equipment composed of two 100-hp horizontal return-tubular boilers supplying steam to a 14-in. x 36-in. Greene engine, which drove countershafting for one double Acme brick machine, one small Centennial brick machine, and one double-mold Raymond brick press. There was also a small engine which drove a lighting generator. Steam drying ovens were also fed from this same battery of boilers. The adjacent brick plant had an equipment of two similar 100-hp boilers supplying steam to an 18-in. x 42-in. Fitchburg engine which ran a lineshaft 1000 ft. long at 149 r.p.m. At the center, west and east ends of this shaft were belted brick machines. This was an air-drying plant. The pumping equipment of the brickyard was composed of a 100-hp boiler supplying steam to a heavy antiquated 18-in. x 42-in. low-speed engine, which was belted through a countershaft to an 8-in. centrifugal pump which takes water from a clay pit and raises it 30 ft. to a canal from which distribution is effected. An old Westinghouse engine was at one time used for this work, but it was less efficient than the low-speed engine. Another 10-hp engine and 4-in. x 4-in. centrifugal pump was installed to force water from a small pond near the plant into the main clay pit.

The investigation showed that a large part of the shafting would remain idle most of the time if each machine were driven by its own motor, and with central-station service better illumination would be available day and night for working and repairs without having to start up the existing small engine and generator. The second yard had two No. 1 and one No. 2 New Haven brick machines, only two of which were in operation at one time. The machine shop could not be run except when the steam engine was in operation, which led to inconvenience 265 days in the year. Coal was hauled to the boilers by teams from a railroad siding. The pumping plant had to be run intermittently. Its boiler had first to be started up and was frequently kept under steam for a number of days at a time. The assortment of engines in service indicated a considerable outlay from time to time for maintenance. The existing units were not economical for the work in hand.

The engine of the first plant showed 121 ihp as an average load when the plant was producing the maximum output. The engine of the second yard showed 24.6 ihp driving the shafting unloaded, and 30 hp when driving shafting loaded (estimated); 69 hp when driving one brick machine (average); 84.5 hp when driving one brick machine (maximum); 50 hp when driving one brick machine (minimum). Deductions from the above showed that with the engine and shafting eliminated, a motor would have to supply $69 - 30 = 39$ hp for one brick machine, or an input of 33 kw. The pumping plant, at its rated speed, raising water 30 ft., would require an input of 35 hp. The old engine would have to supply 52 ihp to do the work, whereas a motor directly belted to the centrifugal pump requires only 31 kw for the same pump performance.

In considering the cost of operating the second brick yard and the pumping plant, 5 per cent was assumed for depreciation and obsolescence, and 5 per cent for maintenance. The plant was considered as having a load of one brick machine for 9 hours per day and for 100 days per season. In case the output came to more or less than the above amount its effect would show with either steam or electric drive. For a proper comparison it was necessary that some definite load be considered. The above load, as shown by tests, required from the engine 69 ihp. This, at 8 lb. of coal per hp-hour, requires 256 tons of coal per year at a cost of $1,150, on the basis of $4.50 per ton. The rate of 8 lb. of coal per hp-hour was taken for the reason that some good plants in the vicinity consume from 5 lb. to 6 lb. per indicated hp-hour.

The pumping plant was considered as operating 24 hours per day for 40 days per year. Although its efficiency was inferior to that of the plant in the second yard, it was assumed as the same. This calls for 200 tons of coal at an annual cost of $900. The labor cost of the plant was estimated at $750 per year. The cost of engine and cylinder oil, lubricants for lineshafting, belt dressing, waste and other materials amounts to about $100 per year. Supplies for the pumping plant are figured at $40 per annum. The operating cost of the steam plant in the second yard would then be, on the basis of a reproduction cost of $4,000: Depreciation, $200; repairs and renewals, $200; coal, $1,150; labor, $750; sundries, $100; total, $2,400. The pumping plant cost of running per year would be, on the basis of $2,000 first cost: Depreciation, $100; repairs and renewals, $100; coal, $900; labor, $300; sundries, $40; total, $1,440. Total cost of steam operation, including fixed charges, $3,840.

The investigation showed that the application of electric motors to brick machines in this case would be made without interfering with the machine output. Motors could be put into position and their driving pulleys secured to the main shaft without any difficulty; then when the machinery was not required for manufacturing purposes, as at night, the plan was to slip on the motor belt, making the entire equipment ready for use. The application of the motor drive to the pumping plant was even simpler. Each brick machine in the second yard would require a 50-hp alternating-current motor running at 865 r.p.m., costing $450. The machine shop required a 5-hp motor running at 1730 r.p.m., at a cost of $71.10. The pumping plant required a 35-hp motor running at 1150 r.p.m., at a price of $360. The priming pump, which was not steam driven, would be satisfactorily operated with a 5-hp motor. One brick plant familiar to the engineers is equipped with 75-hp motors. These are underloaded and ample for the work. Another plant drives one machine satisfactorily with a 60-hp motor, which consumes 7126 kw-hours per month. An engineer made engine tests on a plant using New Haven brick ma-

chines and calculated an average load of 30 hp per machine.

The bills for electric service were estimated on the same basis as was used when considering the cost with steam. This method gave a fair basis for comparing the existing and later costs, and it was felt that if the plants were to run at a greater or less load than that used in the investigation the costs would be similarly affected whether the drive were steam or electricity. Experience shows that the type of motors proposed for the installation do not require repairs to any notable extent. Coal, labor and sundries chargeable to the cost service formerly rendered by steam are practically eliminated by the use of electricity.

The energy consumption of the brick plant per season comes with electrical operation to about 29,700 kw-hours, at a cost of $1,040. An increase in plant output might earn a rate as low as 2.5 cents per kw-hour. The pumping plant energy consumption is about 30,000 kw-hours in 40 days' operation, at a cost of $750. It is probable that if the pumping were distributed over several months the rate would be higher. With electrical equipment arrangements for electric lighting is easier, and there was found to be a great opportunity on the property to improve both the quantity and quality of the output by revising the illumination.

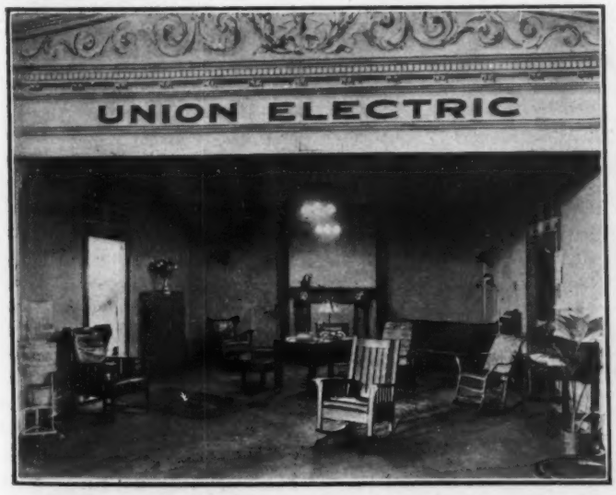
The results of the investigation showed that the cost of operating the second yard and pumping plant by steam is $3,840 per year compared with $1,790, including all charges for operation and investment, with electrical service. Yearly running, intermittent and late service are facilitated by the use of electricity. Local trouble at the boiler-room, engine-room, or anywhere along 1000 ft. of shafting and countershafting required with steam operation the immediate shutting down of the entire plant. This condition was entirely removed by the installation of electric motors, with facilities for increasing the number of brick machines and the freeing of the local superintendent from all anxieties regarding the operation of the former steam equipment. On the strength of the analysis outlined above central-station service was installed and the steam equipment superseded.

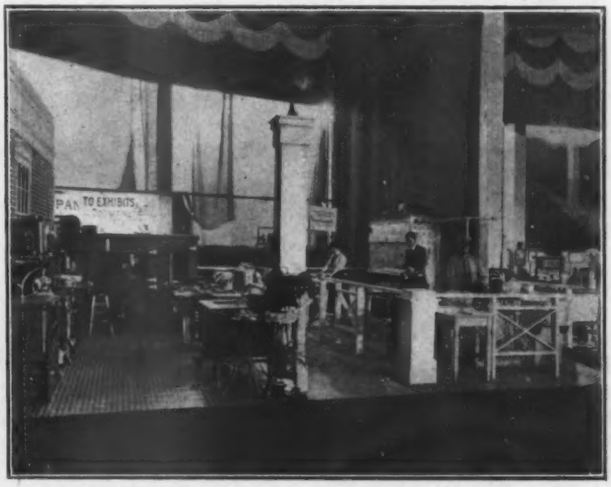
CENTRAL STATION EXHIBIT AT ST. LOUIS ELECTRICAL SHOW.

The exhibit of the Union Electric Light & Power Company at the Electrical Show held in the Coliseum, St. Louis, Mo., May 28 to June 2, was one of the features and drawing cards of the show. The company's display occupied the stage, which has an area of 4000 sq. ft., and at the rear was built a cottage of seven rooms, a living-room in the center, a bedroom to the left and a dining-room to the right. On each side of the stage were displays in the open, shut off by a railing. To the left and directly in front of the cottage was an electric garage. In front to the left was an industrial exhibit. To the right next to the cottage was a kitchen and in front to the right a laundry. The above was placed around an open court, in the center of which was a flower bed 8 ft. in diameter, containing rose bushes, the blooms of which were illuminated with decorative lamps. Around the flower bed in the court were placed garden settees, chairs and tables. The appliances shown in the different rooms were especially applicable to their locations.

Fig. 1—Illumination Outside of the Coliseum, St. Louis, Mo.

The laundry was equipped with an electric washing machine, electrically heated and operated mangle, electrically heated clothes dryer and electric irons. This exhibit was in operation and all table linen from a large restaurant in the neighborhood





Figs. 2 and 3—Living Room, Kitchen and Laundry Exhibit of the Union Electric Light & Power Company.

was washed and ironed in this exhibit. One of the large laundries operated the ironing board, and the attendants were busily engaged ironing shirt-waists, etc. The kitchen was fitted with an electric fireless cook stove and "open-burner cook stove" with oven, electric refrigerator, family motor outfit, electric dish-washing machine and various electric heating appliances adaptable to the kitchen. In the dining-room were a coffee percolator, toaster, luminous radiator, electric flowers, chafing dish, water heater, etc. The table was set and decorated with smilax, natural flowers and decorative lighting outfit, exhaust fan in the wall and bracket fans.

Fig. 4—Dining-Room.

In the living-room were displayed a luminous radiator in mantle, cigar lighter, bracket fans and vacuum cleaner. The bedroom, shown in Fig. 5, had a heating pad, baby milk warmer, water heater, hair dryer, vibrator, shaving mug, shaving mirror, luminous radiator and sewing-machine motor on exhibition. In the garage an electric coupé and electric runabout, with mercury-arc rectifier set, motor-driven air pump, soldering copper and burnishing motor were set off to advantage. In the industrial line there were on view and in operation an envelope machine, shoe-repairing machine, soldering outfit and oil-tempering outfit.

All the above exhibits were operated during the show hours.

Fig. 5—Bedroom.

The rooms in the cottage were equipped with very handsome furniture, and the light effects were obtained from tungsten lamps in ceiling fixtures and brackets on each side of dressing mirror, chiffonier, dresser and dressing table, and portable lamps on tables in bedroom and living-room. The Bell Telephone Company installed an intercommunicating system through the seven rooms. On each post in the court there were oscillating 16-in. fans. In the cottage were floor plugs, baseboard plugs for the purpose of conveniently connecting heating appliances, motors, etc. The exhibit of the Union Electric Company occupied the space which was used by the National Electric Light Association on May 23 to 27 as Hall No. 1, where the general and commercial sessions were held. The National Electric Light Association adjourned at 1 o'clock Friday, and promptly at 2 o'clock the Union Electric Company had its force on the stage and by 11 o'clock Friday night a great deal of work had been done. By Saturday evening at 7 o'clock, when the Electric Show opened, the Union Electric Company's exhibit was complete. Several members of the National Electric Light Association who remained over were surprised to see the transformation which had taken place in such a short time after the stage had been vacated.

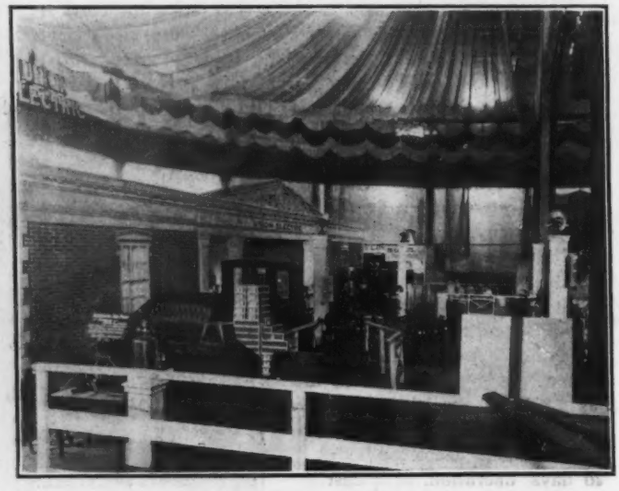


Fig. 6—Garage and Factory.

Wiring and Illumination

VANCOUVER LOW-VOLTAGE TUNGSTEN STREET LIGHTING.

Plans have been completed for substituting incandescent for arc lighting along Granville, Hastings, Cordova and Georgia Streets and Westminster Avenue, in Vancouver, British Columbia, Canada. Use will be made of tungsten clusters similar to those employed in Seattle except that the lighting units on each street standard will not be bunched so closely and will be shaded by sand-blasted instead of ground-glass globes. Each of the standards, which will be placed from 89 ft. to 134 ft. apart on both sides of the street, will be equipped with five 75-cp lamps. The top lamp will be lighted throughout the whole night, while the other four will be turned off at midnight. The standards are 14.5 ft. from sidewalk to center globe, and 10.5 ft. to the lower globe. The diameter at the foot of the column is 7.25 in., tapering to 5 in. The distance between the two lower globes is 3 ft. 3 in. The base of the column is 1 ft. 8 in. square.

The City Council has arranged to provide for the maintenance of the lamps and the supply of the electrical energy, while the property owners will pay the first cost of the installation. The equipment as a whole will cost the property owners as follows: Hastings Street, $2.65 per front foot; Westminster Avenue,

$2.80; Georgia Street, $2.10, and Cordova Street, $2.45. The difference in these amounts is largely due to the fact that on Hastings Street, in accordance with City Electrician McCrossan's plan, the standards will be an average distance of 97 ft. apart; on Westminster Avenue, 89 ft.; on Cordova Street, 120 ft., and on Georgia Street, 134 ft. They will be installed

Vancouver Street-Lighting Standard.

along the curb on each side of the streets mentioned, and there will be one on each corner at all street intersections.

The electrician's specifications call for a very economical installation. The conduits must all be steel and covered with a 2-in. plank, or of 2-in. hydraulic pressed fiber ducts laid in a 3-in. bed of concrete. All service and main conduit wires are to be on the three-wire system, lead encased cable with sheathing not less than 3/32 in. in thickness. The concrete bases for the standards must be 21 in. deep by 24 in. square, with 0.75-in. bolts, 24 in. long, embedded, to which the standards are to be

Fig. 1—Illuminated Windows of Toggery Shop, Brooklyn.

firmly fastened. Each standard is to be equipped with five 75-watt tungsten lamps, one 16-in. and four 12-in. spherically-shaped globes, and in the base of each standard will be a transformer which will reduce the e.m.f. to 11.3 volts. This low voltage will serve to prevent breakage of lamps from vibration caused from passing vehicles and tram cars. Altogether, the specification calls for a strictly first-class installation, and the entire work is to be subject to the approval of the city electrician and city engineer.

WINDOW AND TRANSPARENCY SIGN LIGHTING IN BROOKLYN.

The accompanying illustrations show two examples of window and transparency sign lighting connected to the circuits of the Edison Electric Illuminating Company of Brooklyn, N. Y. Tungsten lamps are employed for this purpose and the same source of illumination suffices not only to light the windows, but the transparency signs painted at the tops of them. The latter is cheap advertising, does not cost much to install or maintain and is effective. Work of this kind is being encouraged in Brooklyn with excellent results. The toggery shop

Fig. 2—Illumination of Shoe Store Window, Brooklyn.

shown in Fig. 1 is lighted by 22 100-watt lamps fitted with prismatic glass reflectors. The shoe store shown in Fig. 2 has 53 100-watt tungstens within the store and 52 100-watt tungsten lamps serve to illuminate the windows.

RECENT DEVELOPMENTS IN PHOTOMETRY.

Two meetings recently held by the Illuminating Engineering Society in London were devoted to a discussion on the measurement of light and illumination. As has been the practice at meetings of this society, a number of communications were presented by foreign corresponding members, and a feature of the proceedings was the exhibition of photometric apparatus. Some rather novel points in connection with the subject were brought forward and the discussion showed great differences of opinion between different authorities. There are, indeed, few subjects on which an exchange of views is more needed than that of photometry.

One of the matters which received a considerable amount of attention was the sensitiveness of different types of photometers. Here the discrepancy between the views of different authorities was very marked. For example, several speakers spoke in the highest terms of the grease-spot photometer, contending that, when properly prepared, it was superior to the Lummer-Brodhun. The president, however, did not like this kind of screen, but could get excellent results with the Lummer-Brodhun instrument. Mr. L. Wild had yet another modification of the same type of instrument to show. He used a patch of silvered mirror on plane glass, one of the surfaces illuminated being seen through the transparent glass and the other by reflection from the mirror. For this he claimed that a change of illumination of 0.2 per cent could be detected.

Mr. J. S. Dow laid stress on the differences in the results of various observers. He also pointed out that the sensitiveness of any photometer depended very greatly on the intensity of illumination of the screen. The results obtainable improved steadily as the illumination was increased up to about 10 lux, but after this point an increased illumination had but little effect. It was also interesting to note that approximately the same results were obtained with red, green and white light.

Another matter which received some notice was the determination of polar curves of light distribution of illuminants.

It is to be noted that considerable progress has recently been made in methods of simplifying the calculations involved in deducing the mean spherical candle-power and the flux of light from these curves. But there seems still great scope for improvement in the methods of obtaining these curves experimentally. This is probably quite the most serious operation that the photometrist is called upon to carry out and any means of lessening the work would be very gratefully received. In this connection Mr. Dow referred to the use of the thermopile and the selenium screen as recently developed by Presser and Voege in Germany. These "physical" photometers must, of course, ultimately be calibrated by the eye and must be employed with great caution. But it may be pointed out that they may quite conceivably be found of service for comparative measurements, such as polar curve determinations. Voege has even devised an apparatus for recording polar curves automatically by this means and the selenium cell has been made use of for the automatic registration of astronomical phenomena, the variation of light during the solar eclipse, etc.

One difficulty which most workers seem to have experienced is the unsteadiness during a lengthy test of certain forms of arc lamps, particularly those utilizing flame carbons. This naturally leads to great inconvenience in obtaining polar curves of light distribution. Prof. J. T. Morris, of the East London Technical College, referred to this difficulty and showed a series of diagrams illustrating the "peppering" of the points from which curves had to be drawn. However, he partially got over the trouble by the use of a double set of inclined mirrors. Another case in which the unsteadiness of sources of light is a considerable drawback is the testing of the absorption of globes and reflectors. These considerations led Mr. J. G. Clarke, of the Gas, Light & Coke Company, to express a desire for something in the nature of a "ballistic" photometer—that is, a photometer which would take the mean of a series of rapidly fluctuating readings, and thus integrate the result with regard to time, just as the Ulbricht globe does with regard to space. It must be admitted, however, that the possibility of securing this result with a photometer of the ordinary kind seems rather remote, though perhaps it might be attained by purely physical means. While referring to this matter it is interesting to note the increasing attention paid to the globe photometer. Several speakers referred to the progress that has been made with this instrument in Germany, and experiments have recently been undertaken by Dr. Sharp and others in the United States. Dr. Sumpner, the principal of the Birmingham Technical School, had a very ingenious method of determining the total amount of light yielded by a source. He arranges a long, vertical strip of paper, illuminated by the arc lamp to be tested, and having a variable width corresponding to the factors for the various zones in which light is to be measured. The total amount of light reflected from this sheet is then measured photometrically and is regarded as proportional to the total candle-power of the source. However, the measurement of light emitted from such a large area presents certain difficulties in practice.

More recently Dr. Sumpner makes another suggestion. He contends that the inconvenient spherical form of the Ulbricht globe photometer is not really necessary and that equally accurate results could be obtained from a cubical box with a whitened interior. This would probably be much more easy to build than a globe. Other types of instruments for the determination of the total amount of light from a lamp have been developed by Professor Blondel. In the May number of *The Illuminating Engineer* (London), he describes the Lumenmeter, the Mesophotometer and other forms of apparatus designed for this purpose. He also presents illustrations of a number of recent forms of illumination photometers.

The second meeting of the Illuminating Engineering Society was mainly devoted to the discussion of the measurement of illumination. Controversy once more raged round the question as to whether it was desirable to measure the illumination in a horizontal or vertical plane, and whether it was most convenient to measure the illumination direct or to calculate it from a knowledge of the sources. Mr. J. G. Clarke, for example, suggested that the most convenient method, once the illumination had been determined and found to be satisfactory, is to concentrate attention on the light yielded by the lamps themselves, since this could be measured, on the whole, with greater accuracy. It was also desirable to determine something which would not be affected by the many changes in the reflecting power of the wall paper and surroundings, etc. In such circumstances, he urged, it is necessary to be able to discriminate between changes in the illumination due to defects in the lamps themselves and changes which are the result of alterations in external conditions.

A feature of the meeting referred to was the demonstration of the use of illumination photometers. The Trotter universal photometer, the Harrison instrument, the Simmance-Abady street photometer, and the Martens illumination photometer were all exhibited and actual measurements of the illumination in the lecture theater were taken. An interesting experiment in the course of the proceedings was the substitution for the present electric lighting of the old gas cluster of flatflame burners, which are now used only for ventilation purposes, but at one time formed an essential part of the lighting equipment of the theater. The change in the standard of illumination within recent years is very marked. Mr. P. J. Waldram also explained the use of his daylight attachment for use with the Trotter photometer in examining the provision of daylight in interiors. By aid of this instrument the relation between the illumination due to the unrestricted daylight outside and that due to the actual light available within is determined. This factor should remain the same independent of a wide variation in climatic conditions, and, therefore, presents a rough means of ascertaining whether the window space, and the provision for daylight generally, can be considered adequate.

One other matter which was commented upon by authorities in Great Britain, France, Germany and the United States, was the need for better photometrical equipment of technical colleges and better facilities for instruction in general problems connected with illumination. It was invariably conceded that the present arrangements were exceedingly unsatisfactory. In many cases the apparatus provided was stated to be obsolete and insufficient; there was as a rule too much stress laid on the purely theoretical aspects of the subject and too little attention was paid to the practical importance of proper methods of measurement in actual engineering problems.

NEW TELEPHONE PATENTS.

COMBINED SIGNAL AND TELEPHONE SYSTEM.

As is well known the dispatch system of interurban electric railroads has depended for its success upon the car crews calling up train dispatchers under certain specified conditions or at specified points or times. An important improvement, of course, is the introduction of some visual or audible signal under the control of the dispatcher, which will instruct a motorman to stop and call up. It is with such a signal system, combined with the telephone line, that the patent of Mr. H. O. Rugh, of Sandwich, Ill., is concerned. His system is adaptable to both audible and visual signals and not only may the desired signal tower be selected, but the dispatcher also has the choice of two signals.

The system is a step-by-step one, the selectors at all towns being under control of polarized relays, which in turn are connected to and controlled by current impulses upon the telephone line. Impulses of one polarity cause the advance of the selector step by step. Each step corresponds to the local circuits of one tower selector. These local circuits each contain two relays in series, one high resistance and one low. The high will prevent the operation of the low, while a shunt on the high will permit the operation of the low. Such a shunt is arranged through front contacts of the selector operating arm. Therefore, if the last impulse be drawn out indefinitely by the maintaining of the sending circuit closed, the

low relay will operate to set its signal. If the last impulse be of normal length the selector arm will fall back and the high wound relay will operate. One reversed impulse on the telephone line restores all selectors. The patent for this system is assigned to the Sandwich Electric Company.

COMPOSITE SYSTEMS.

More and more attention is being given to the composite use of lines to improve their "time efficiency" and, therefore, to cut down the line costs. Such composite systems now include not only the old combination telephone and telegraph line, but also combinations of two telephones; fire alarm and telephone, etc.

In the telegraph and telephone class falls the system patented by Mr. G. E. Hines. The peculiarity of this system lies in the use of induced current impulses for the operation of the telegraph relay. To this end, the telegraph key circuit is local. When the key is depressed, the local circuit is closed and direct current is produced in the primary winding of a repeating coil or transformer. When the key is released, the discharge of the coil, due to self-induction, takes place through a condenser and resistance shunted around the key. Simultaneously with the beginning and cessation of current through the primary coil of the transformer, induced current impulses in first one direction and then the other are sent out over the line. The telegraph relay is especially adapted to respond properly to these impulses. The circuit contains the usual condensers and retardation coils for separating the telegraph and telephone currents and a special retardation is included for "rounding off" the telegraph impulses to reduce the liability to disturbances in the telephone circuit.

A patent granted to Mr. W. W. Dean describes a signal and telephone system. In this system the fire alarm receiving relay at the central office is in series with a condenser, both being bridged across it. This relay is responsive to rather high frequency alternating currents only. When the alarm device at the substation is released through the closure of the local circuit or such other means as is provided, the telephone line becomes disconnected from the telephone instrument and connected through an induction coil secondary and a messenger call device. Simultaneously the circuit of the local signal battery is closed through a vibrator and the induction coil primary. It will be seen that when an alarm is being sent there is introduced upon the line, and thus communicated to the central receiving relay, a high-frequency current, broken by periods of no current corresponding to the code on the signal wheel.

A combination system patented by Mr. O. M. Leich, of Genoa, is a railway system adapted for simultaneous use as a through circuit and as an inter-block system. The line is divided into sections by the introduction of repeating coils at alternate block stations. Thus, each section has one intermediate block station connected. The repeating coils transmit voice currents and high-frequency signal currents, which are used for the through or main-line conversations with the dispatcher.

For inter-block working, each line section is used as a grounded line, the signal and telephone apparatus being connected between the middle point of the repeating coils and ground. Thus at each repeating-coil station there are two bells, one connected to the forward or outward line section and one to the inward line section. At the intermediate station of each section a retardation coil, with the midpoint brought out, serves for a point of connection of the local telephone set. It will be understood that with such a combination of metallic and grounded circuits simultaneous signaling and conversation may be carried on independently on several line sections and on the through line.

An additional feature of the system lies in the selective signaling of the stations on the local grounded system. Polarized bells of the biased type are used, and the generator is arranged to send out impulses of either positive or negative polarity as desired. As there are but three bells to the section, one of these the calling station bell, selection is readily accomplished.

SIGNALLING APPARATUS.

The signalling system patented by Dr. D. W. Kneisly, of Dayton, Ohio, and assigned to the Dayton Telephone Lockout Manufacturing Company, is of the step-by-step lock out type. At each station there is a polarized operating coil before which a pawl actuating level is hung. Current impulses of a given polarity cause the various levers to act simultaneously, each driving forward a toothed sector, the angular displacement of which corresponds to the successive stations, at the position corresponding to the station called, because of a particularly deep tooth under the pawl, the lever is given an abnormal throw, thereby closing the bell circuit and unlocking the switch hook. A reversed impulse on the line serves to tilt the polarized armature of the actuating magnet. This armature in turn removes the back stop of the actuating lever, the excessive return stroke of which withdraws both actuating and retaining pawls.

LETTERS TO THE EDITOR.

Commutation.

To the Editor of Electrical World:

SIR:—I have read with much interest the very able article in your issue of March 31, 1910, by Mr. E. W. Carter on "Commutation." I note that the author demonstrates on page 806 that if the contact resistance decreases near the end of the commutation period faster than $x=1-\frac{t'}{T}$ (T being the total time of short-circuit), the tendency to an infinite current disappears whatever the value of $\frac{RT}{\Lambda}$ This demonstration supposes that the area of contact on the toe segment varies as x^β, where $\beta>1$. I may point out that two years ago I published a more general demonstration [*Lumière Electrique*, 4, III (2me Série) p. 67] which applies even if the area s is an arbitrary function of x. The *sufficient* condition for a finite edge-density is

$$\left[\Lambda\frac{ds}{dt}+\rho\right]_{t=T}>0, \qquad (1)$$

where ρ is the contact resistance per unit area. If we put, therefore,

$$s=k\left(1-\frac{t}{T}\right)^\beta, \ (\beta>1),$$

the condition (1) is evidently always filled.

Paris, France. J. F. J. BETHENOD.

Calculating Illumination.

To the Editor of Electrical World:

SIR:—The writer has noted with interest the article by Mr. Parks in your issue of March 24, 1910, and the article by Mr. Wohlauer in your issue of May 12, 1910, both of which articles give interesting methods of calculating illumination on a horizontal plane from inclined light sources. It may be of interest at this time, therefore, to recall the method published by the writer about three years ago.

The writer showed that illumination from an inclined light source could be calculated from the usual formula, but that the value of the candle-power to be used in the formula must be taken at that angle on the photometric curve, which is equal to the angle made by the axis of the lamp, and the line of direction to the point at which the illumination is to be calculated. Calling this angle θ, it was proved that it could be found from the following formula:

$$\cos\theta=\sin\phi\sin A\cos B+\cos\phi\cos A,$$

where ϕ is the angle made with the vertical by the line of direction to the point, A the angle of inclination of the lamp axis to the vertical, and B the horizontal angle, or angle in azimuth, between the axis of the lamp and the line of direction to the point. This formula for a special case was given at the first convention of the Illuminating Engineering Society in Boston, in August, 1907, and appears in the *Transactions*, Vol. II, No. 7, October, 1907.

Boston, Mass. J. S. CODMAN.

Furnace Electrode Losses.

To the Editor of Electrical World:

Sir: Permit me to call attention to a slight error in your brief abstract on page 1190 of your issue of May 12 of one of my papers read at the Pittsburgh meeting of the American Electrochemical Society.

Concerning my first paper describing the experimental determination of the constants necessary for calculating electrodes, you say that "the results" were "given in a paper read at the Charlotte meeting of the A. I. E. E." (for your abstract of that paper see page 848 of your issue of April 7th). This is an error, in so far as the "results" of these determinations are given also in the present paper, which is complete in itself. Your abstractor has confused it with the fact that in the Charlotte convention paper these results were analyzed, compared and discussed, and hence, of course, it also includes them.

Concerning my second paper at the Pittsburgh convention, I take this occasion to call attention to a point not mentioned in your abstract, but which seems to me to be of considerable importance in view of the fact that it answers the important point raised in a prolonged discussion of previous papers, in which discussion great stress was laid on the correction due to the temperature coefficients of the conductivities, which correction my adversaries had claimed was very great. By the method described in the present paper all these correction factors are completely taken care of by the use of two new quantities in place of the older ones, and hence the doubts raised concerning these corrections have been completely met. I take the liberty to call attention to this because your abstract omits any reference to it, and because I find that some of the readers of that paper have failed to notice this important point. The present conclusions, therefore, are that the complete method as originally described gives correct and reliable results.

Concerning the abstract of Mr. Gillette's discussion, I desire to add that his attempts to throw doubts on the correctness of my results have no weight and do not apply, because in the first place he did not wait until the stable state was reached, which is a matter of extreme importance; and in the second place, he was operating his electrodes under entirely different conditions than the fundamental conditions laid down in my papers, and therefore, there is absolutely no reason why his results should agree. Hence the fact that they do not, does not prove any incorrectness in my results, as he claims they do. Had he proportioned the electrodes in accordance with the instructions given in my papers, and had he continued running his furnace until the stable state had been reached (which may take hours), I feel sure that his temperature measurements, if correct, would have borne out my results. I have calculated as well as I could from his description, under what conditions he was operating his electrodes, and found that he was not getting anything like the good results that I am sure he might have obtained, and that, therefore, his furnace was very poorly designed.

Philadelphia, Pa. Carl Hering.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Commutation Phenomena in Direct-Current Machines.—G. W. Worrall.—The conclusion of his paper on commutation phenomena and magnetic oscillations occurring in direct-current machines. The author discusses the influence of speed on commutation ("critical sparking speed"), the influence of the commutating e.m.f. on commutation, the effect of the width of the commutating pole, and the cause of the difference in behavior of the positive and the negative brushes. Magnetic oscillations occurring in the machine parts, both in the main poles and in the armature, are also discussed. The general results of the author are as follows: The natural period of the short-circuited coil may be varied by varying its contact resistance, or by properly disposing the resistance over the brush surface. Sparking depends upon the relation of the natural period to the available period. The maximum rate of change of the current during commutation may be reduced by reducing the natural period, and at the same time the overload range capacity of the machine as regards sparking will be increased. The maximum rate of change may also be reduced by accelerating the commutation during the early portion of the short-circuit period by means of a commutating e.m.f. and this has the same effect as reducing the natural period of the coil. The ampere-turns necessary on the commutating poles may be reduced if the flash across the slot be used to generate the commutating e.m.f. The e.m.f. generated in such a manner possesses approximately the correct wave shape and the magnetic oscillations in the armature teeth during commutation are thereby reduced. If only one commutating pole be fitted, the ampere-turns necessary are less than when two are in use. The commutating pole flux fulfills two functions: (1) To generate the commutating e.m.f.; and (2) to oppose or press back the armature reaction flux. The negative brush is hotter than the positive; the higher temperature causes the negative to take a higher polish than the positive, thereby reducing its contact resistance. The lower contact resistance increases the natural period, and renders the negative brush more liable to sparking than the positive. The higher temperature of the negative brush causes it to expand more than the positive. The forward tip is generally the hottest part of the brush surface, because it is shielded from draughts. The forward tip is alternately heated and cooled as the segments pass under it, and vibrates with the frequency of the segments. This vibration renders the brush unstable and the commutation irregular. The forward tip may be cooled, the vibration avoided, the commutation made regular, and the sparking limit raised by a piece of metal in good contact with the brush at the forward tip and provided with a relatively large radiating surface. The same results may also be obtained by preventing the rush of current at the end of commutation, either by reducing the natural period of the coil or by accelerating the commutation during the early stages by means of a commutating e.m.f. The vibration of the forward tip of the brush causes a minute arc to be set up periodically between the carbon and the commutator, which action causes a brown band to form on the brush and a deposit on the commutator.—Lond. *Electrician*, May 20.

Rectifier.—J. Reyval.—In a continuation of his illustrated article on the recent exhibition of the French Physical Society in Paris, the author describes a rectifying device by Soulier for charging some storage cells from an alternating-current circuit. In telephony the movements of the diaphragm are sensibly synchronous with the alternating current which passes through the coils. If the diaphragm makes sufficiently large movements to be utilized for making and breaking a contact, such a diaphragm can be used for rectifying an alternating current. When the frequency of the alternating current changes, as is continually the case in telephony, the diaphragm follows faithfully these changes. The rectifier is shown in Fig. 1. It consists of an auto-transformer, with a closed magnetic circuit, and is connected to an alternating-current circuit of 110 volts or 220 volts. The essential part of the rectifier is a thin vibrating steel plate *FF* stretched between two supports *A* and *B*. This plate has at its center a contact made of a special alloy which does not oxidize. This contact piece is pressed lightly against another contact of the same material on *C*. The pressure is regulated by means of the screw *V*. Opposite

to the vibrating plate, and at a short distance from it, there is an electromagnet *YZ* excited by direct current taken from the storage cells to be charged, the points of connection being *r* and *s*. One only of the poles of this electromagnet is provided with an auxiliary magnetizing coil *E* through which the alternating current of the network passes, connections being made to the points *m* and *n* of the auto-transformer winding. The points *p* and *q* of the auto-transformer winding are connected in series with the storage battery *s r* to be charged, the contact *C*, and the vibrating diaphragm. The number of turns of the auto-transformer between the points *p* and *q* depends on the voltage of the direct current which is to be obtained—that is, the number of storage batteries to be charged. The direct current which passes through the coils *Y* and *Z* produces a fixed magnetic flux in the iron core, making a north pole in *E*. If the alternating current is passed through the coil *E*, its magnetic flux is superposed on that produced in the coils *Y* and *Z*, and the diaphragm will follow all changes of the alternating current. An interesting peculiarity of this device is that it is not necessary to concern oneself as to which pole is positive and which negative. However the storage battery may be connected it will be charged and not discharged. This paradox is explained by the fact that the electromagnet *YZ* is excited by the storage battery to be charged. In the above device only one-half wave of the alternating current is utilized. To utilize both halves Soulier has devised a rectifier with two vibrating diaphragms.—*La Lumière Elec.*, May 7.

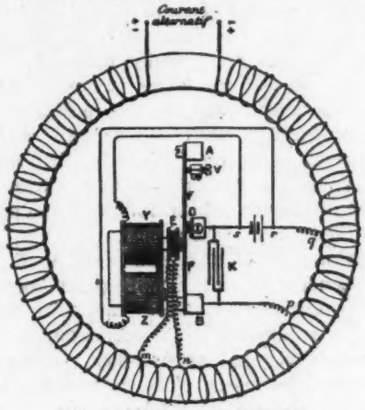


Fig. 1—Diagram of Rectifier.

Single-Phase Induction Motor.—F. SCHMIDT.—A theoretical note on the theory of the single-phase induction motor in which the author criticises the usual way of stating the theory of this motor. He shows, with the aid of diagrams, how the pure single-phase motor without any artificial phase produces its rotating field and its torque.—*Elek. und Masch.* (Vienna), May 8.

Short-Circuit Losses in Alternating-Current Commutator Motors.—A. FRAENCKEL AND B. J. M. LANE.—The first part of a paper illustrated by diagrams in which results of experimental researches on the losses due to the short-circuit currents in alternating-current commutator motors are given. These show a rapid increase of the loss with increasing speed, other conditions being equal. An explanation of this phenomenon is given, and oscillograms are shown from which the decrease of the short-circuit current with increasing speed, and for a given short-circuit e.m.f. is deduced. The influence of the short-circuit currents on the line pressure and current is illustrated.—Lond. *Electrician*, May 20.

Synchronous Motors.—A. GHEYSENS.—An article, with reference to the recent paper of Isambert, on the characteristic diagram of the operation of synchronous motors.—*La Lumière Elec.*, May 21.

Lamps and Lighting.

Moore Vacuum Tube.—W. WEDDING.—The first part of a paper illustrated by diagrams giving the results of tests of a Moore vacuum-tube installation of 3-kw rating and a length of 37.5 m of luminous tube. The candle-power for a ring 1 cm in breadth and the specific consumption were determined. The effect of frequency, the influence of self-induction, and the voltage and current curves in the primary and secondary circuits were experimentally determined and a comparison was worked out of the Moore vacuum tube with carbon incandescent lamps and with tungsten and tantalum lamps with respect to specific consumption and comparative brightness. The paper is to be concluded.—*Elek. Zeit.*, May 19.

Incandescent-Lamp Lighting.—T. W. ROLPH AND C. E. CLEWELL.—An illustrated article by Rolph on the advantages of the use of reflectors with incandescent lamps, and illustrated notes by Clewell on the best arrangements for office lighting.—*Elec. Jour.*, May.

Generation, Transmission and Distribution.

Italian Power Plant.—L. PASCHING.—An illustrated description of the Cervara water-power station of the Societa Industriale Elettrica della Valnerina in Terni. It contains five 1900-kva, three-phase generators, directly coupled with 2200-hp turbines, and two 865-kva generators. Energy is supplied at 3750 volts for lighting and motor services in Terni and transmitted at 27,000 volts to the calcium carbide works in Narni.—*Elek. u. Masch.* (Vienna), May 15.

London Power Station.—An illustrated description of the new station which has been erected in Horseferry Road for the Westminster Electric Supply Corporation to replace the company's original Millbank Street station, as the site of the latter has been acquired by the Council for extension of the Thames embankment. The station is equipped with direct-current turbo-generators at present aggregating 3000 kw, not including steam balancers. There is also converting plant for dealing with the three-phase supply from the Grove Road station of the Central Electric Supply Company. Condensing water is taken from the river through pipes over 300 ft. long. Special arrangements, including the use of a battery, are employed to ensure continuity of supply to the House of Parliament.—Lond. *Electrician*, May 20, and *Elec. Eng'ing*, May 19.

Power Plant in Argentina.—An illustrated description of an electric power plant which is being completed in Argentina and which involves the lighting and tramways of the town of Bahia, Blanca, and energy supply to the harbor. The new station contains three 1250-kva alternators and two 1000-kva alternators, but these represent only one-fourth of the final size of the station. The chief features of interest are Browett, Lindley & Company's improved expansion gear for the engines, the main object of which is to utilize oil pressure for actuating a relay motor to move the gear, and the use of Leblanc-Westinghouse condensing plant.—Lond. *Elec. Eng'ing*, May 19.

Transmission Plants for Agricultural Districts.—MARX.—The author endeavors to show that the erection of a power plant and transmission system for an agricultural district should not be undertaken by a Genossenschaft (a kind of commercial union as distinguished from stock companies or private and municipal enterprise). Such a union may buy energy, but should not undertake its generation.—*Elek. Zeit.*, May 19..

Electric Service on Docks.—An illustrated description of the electrical equipment of Smith's Docks in Middlesborough, where motors are used in connection with cranes and for pumping and machine-tool driving in the machine shop. Alternating current is employed except for lighting.—Lond. *Electrician*, May 20.

Traction.

Electric Locomotives.—A note stating that the Bernese railway authorities have recently ordered some electric locomotives for operating the Loetschberg line. They will be of two different types of construction. The first type is carried on two bogies, the three axles of which are coupled together. Each of these bogies is operated by a 1000-hp motor through cranks and gearing. Each motor is fed with energy at a pressure of 420 volts, the line e.m.f. being 15,000 volts. The electrical equipment weighs 42 tons, and the locomotives complete weigh 86 tons, the axle pressure being 15 tons, except on the two end axles, where it is 13 tons. The tractive effort is 12.8 tons at

a speed of 26 miles an hour. The second type of locomotive has a rating of 1600 hp, and is made up of two identical units coupled together. Each of these units is fitted with motors which drive the axles through cranks, but without gearing. Each motor receives energy from the secondary of a transformer, the rated output of each unit being 800 hp. The electrical equipment weighs 50 tons and the locomotive complete weighs 93 tons. These machines are designed for running at from 43 to 45 miles per hour.—Lond. *Electrician,* May 20.

Installations, Systems and Appliances.

High-Tension Direct-Current Series System.—A note on a recent British patent (11,304, 1909; May 12, 1910) of T. von Zweigbergk. When a number of high-tension direct-current motors are connected in series with one circuit-breaker, a flash-over may occur on the commutator of one machine without the breaker operating, as the back e.m.f. of the other motors may keep down the current. An arc may thus be formed across the commutator in question. In order to avoid this, insulated terminals connected directly to the circuit-breaker are provided above each commutator. Should any machine flash over the arc is immediately transferred to the terminal above the commutator, and the circuit-breaker is operated.—Lond. *Elec. Eng'ing,* May 19.

High-Voltage Indicator.—H. Zipp.—Something over 50 per cent of all the fatal accidents caused by electricity in Germany in 1908 were due to the touching of high-tension overhead lines. This is sometimes the result of pure carelessness, but often it is due to mistaking a live conductor for a harmless one. Many attempts have been made to produce a simple, portable and cheap indicator, such as could be carried by each workman on the line and which would serve to distinguish live wires from others. For various reasons none of these has come into very widespread use, but a new form has recently been put on the market by the Land & Seekabelwerke. It consists of an ebonite case containing a vacuum tube and a small glass condenser having about 0.0001 mf. capacity. One end of the vacuum tube is provided with a metal hook for hanging on the line, while the other end of the tube is connected to the condenser, and this again to an earth terminal at the other end of the ebonite case. When the hook is applied to a live wire while the earth terminal is more or less completely earthed, the vacuum tube lights up distinctly. There is little danger from touching the earth terminal because the current passing is less than 2 milliamperes. For 5000 volts the instrument is about 12 in. long and 1½ in. in diameter and weighs 1 lb. For every additional 5000 volts an extra condenser is added, and the weight and length are somewhat increased. The instrument is also handy for indicating like poles of transformers, etc., which have to be put into parallel, and in some cases it is fitted permanently on switchboards to take the place of a voltmeter in indicating when certain circuits have been switched on.—*Elek. Kraftbtr. u. Bahnen.,* May 4; Lond. *Elec. Rev.,* May 20.

Wires and Wiring.

High-Tension Cables.—M. Hoechstaedter.—A continuation of his long article on the dielectric properties of high-tension cables for e.m.fs. above 20,000 volts. The systematic investigation of a certain cable shows that the dielectric loss follows laws very similar to the ferromagnetic hysteresis loss. The "true capacity" for alternating current is fixed and its value is shown to be constant and to agree with the value of capacity found by the ballistic method.—*Elek. Zeit.,* May 19.

Electrophysics and Magnetism.

Electrification of Insulating Materials.—W. Jamieson.—A paper read before the Glasgow Section of the (Brit.) Inst. Elec. Eng. The best insulating material for producing electrification in a humid atmosphere was found to be a rolled celluloid sheet, particularly when the surface is well burnished. When two pieces of this celluloid sheet are drawn smartly between the finger and thumb, not only are the outsides electrified, but the inside surfaces as well, one being positively, the other negatively electrified. The reason is that when the two strips are drawn through the fingers they are not only compressed, but bent to one side or the other. Of the two inner surfaces in contact, one is concave and the other convex—that is, the particles of the one surface are in compression and those of the other in tension. The molecular difference due to this tension and compression combined with the direct pressure produces the electrification. Of the surfaces in contact the one in compression is, for celluloid, always negatively electrified, and the one in tension is positively electrified. In many small electrical machines there are layers of insulating materials, for example, in transformers, due to the alternating field setting up vibrations, and in generators due to want of balance and change of flux. Is it possible that these layers could become statically charged in the way mentioned? To test this a layer of strips of celluloid was carefully diselectrified and mounted, bent and compressed on the base of a small motor running at 3000 r.p.m. The spindle carried an eccentric load, thus vibrating the layers. After a time the layers showed electrification as a whole, while the separate strips were strongly electrified. At the same time a number of strips were fixed to the edge of a wooden disk (keyed onto the shaft of the motor) and loaded. This disk was eccentrically mounted. On rotating the motor at a rapid rate the layers became electrified as before. These experiments suggest the possibility of static charges being produced in electrical machines simply by vibration and rotation; it is possible, therefore, that cases of insulation breakdown may occur through these causes alone. An account of the discussion which followed the paper is also given.—Lond. *Electrician,* May 20.

Magnetic Balance.—C. Cheneveau and A. C. Jolly.—An abstract of a London Physical Society paper on the magnetic balance of Mme. Curie and C. Cheneveau. This balance is intended for the determination of the coefficient of specific magnetization, susceptibility and permeability of feebly paramagnetic and diamagnetic bodies. The body under investigation is suspended from one arm of a torsion balance, which measures the force exerted on the body when it is placed in the non-uniform field of a permanent magnet. The torsion balance is formed by a horizontal rod suspended by a long fine platinum wire and carrying at one end a hook from which the substance under investigation can be suspended in a small enclosing glass tube. On the other end of the torsion arm is fixed a copper sector which moves between the poles of an auxiliary magnet and thus provides efficient damping. There is also provided a second branch arm upon which may be placed suitable counterweights to balance the specimen. The suspension carries a mirror, and the movements are read on a translucent scale in the ordinary way. The magnetic field is that of a large circular permanent magnet mounted in such a way that the vertical gap may be made to describe a semicircle of radius equal to the length of the torsion arm, and the movements of this magnet are controlled by the observer at the screen by means of cords. An empty containing tube is first mounted on the balance, and the maximum deviation of both sides of the zero is obtained by bringing up the magnet toward each side of the specimen. The tube is now filled to a given mark with a known mass of pure distilled water and the variations are observed as before. The water is now replaced by a known mass of the substance to be examined occupying the same volume or the same vertical height, and again the deviations are observed. Experiments have been performed with various metals and alloys. An account of the discussion which followed is also given.—Lond. *Electrician,* May 20.

Spark-Gap Phenomena.—J. M'Whan.—A paper read before the Royal Society of Edinburgh. The author describes phenomena observed in connection with a solid dielectric placed between the terminals of an induction coil or influence machine. Experiments on the repulsion of the dielectric, the characteristics of the brush discharge, the influence of low pressure, etc., are described.—Lond. *Electrician,* May 20.

Resistivity of Nickel and Aluminum.—H. Pecheux.—An article giving the results of measurements of the resistivity of nickel and aluminum and their alloys (ferro-nickel, copper-aluminum), and their industrial applications for conductor wires and resistance wires.—*La Lumière Elec.,* May 21.

Vector Diagrams.—F. PUNGA.—A mathematical article illustrated by diagrams, giving a new method of representing power and energy in vector diagrams.—*Elek. u. Masch.* (Vienna), May 15-22.

Electrochemistry.

Electric Resistance Furnace.—F. A. J. FITZGERALD.—An illustrated description of a new type of resistance furnace, in which the charge is heated by radiations from a resistor. An account is given of experiments with zinc melting. The efficiency is as high as 78 per cent. Very great economies can be obtained by building the furnace with double walls, bottom and cover, and burning fuel between the inner and outer walls.—*Met. and Chem. Eng'ing,* June.

Electric Hot Plate.—A description of the construction of a simple and efficient laboratory electric hot plate devised in the laboratory of a Western metallurgical company.—*Met. and Chem. Eng'ing,* June.

Units, Measurements and Instruments.

Silver Coulometer.—E. B. ROSA, G. W. VINAL AND A. S. MCDANIEL.—An abstract of an American Physical Society paper on the effect of filter paper upon the mass and form of the deposit in the silver coulometer. The Rayleigh coulometer, which has been widely used and many times investigated in several different countries, and has generally been found to yield a heavier deposit of silver than the Kohlrausch or Richards forms, in which filter paper is not employed. The difference has been attributed to secondary reactions at the anode, in which a complex ion is formed; this complex ion, being brought to the cathode by convection currents, has been supposed to yield a larger quantity of silver for each univalent charge. The present authors have shown that the trouble with the Rayleigh coulometer is not due to anode products, but to the reduction of neutral silver nitrate by furfuraldehyde resulting from the hydrolysis of the cellulose of the filter paper, the heavier deposit resulting from a certain quantity of colloidal silver that is produced and deposited together with that carried by the current. The colloidal silver not only increases the mass of the deposit by an appreciable amount, but changes the form of the deposit, as seen by the unaided eye and also as observed by means of a microscope.—*Phys. Rev.,* May.

Silver-Nickel Thermo-Element.—G. VON HEVESY AND E. WOLFF.—An article giving the results of tests of a silver-

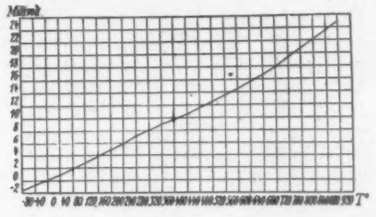


Fig. 2—Curve of Thermo-e.m.f.

nickel thermo-element which has the advantage of being inexpensive and suitable for temperature measurements between —80 deg. C. and +920 C. Fig. 2 gives the thermo-e.m.f. in

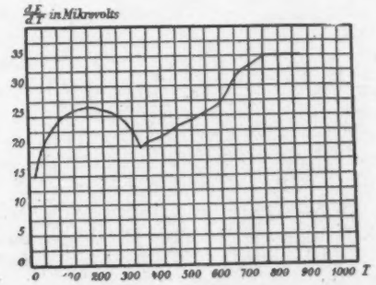


Fig. 3—Curve of Temperature Coefficient.

millivolts (ordinates), the abscissas being the temperature in degrees Centigrade of one junction, the other junctions being kept in ice at 0 deg. C. Fig. 3 gives the curve of the temperature coefficient of the thermo-e.m.f. There is a maximum at 180 deg. C. and a minimum at 370 deg. C. The maximum value of the temperature coefficient is 35.0 and the minimum value 17.9 microvolts per degree Centigrade.—*Phys. Zeit.,* May 15.

High-Tension Voltmeter.—A. TSCHERNYSCHEFF.—An illustrated description of a voltmeter for tensions from 10,000 volts to 180,000 volts. It is an electrostatic balance in which the electrostatic forces of attraction between two disks are balanced by the magnetic attractions between two coils through which the same current passes. This current is a direct indication of the voltage to be determined. The essential feature of the instrument is the use of a compressed gas at 10 atmospheres pressure as insulating material between the two disks attracting one another.—*Phys. Zeit.,* May 15.

Standard Tests of Sheet Iron.—The standardization rules of the German Association of Electrical Engineers on the magnetic testing of sheet iron have been revised and the new rules will be voted on at the next meeting of the association. The total loss in iron is to be determined by means of a wattmeter from samples taken from at least four plates, their weight being at least 10 kg. The loss is to be given for $B_{max} = 10{,}000$ c.g.s. units and for $B_{max} = 15{,}000$ c.g.s. units in watts per kilogram and at a temperature of 20 deg. C. These figures relating to a sinusoidal voltage curve are called the "loss figure" (Verlustziffer) and designated by V_{10} and V_{15}. The "aging coefficient" is the percentage change of the loss figure $B_{max} = 10{,}000$ after 600 hours' heating at 100 deg. C. To indicate the magnetic properties of the iron, the flux density is to be given in c.g.s. units for 300 amp-turns per centimeter and for one of the following three magnetizing forces either 100 or 50 or 25 amp-turns per centimeter. The specific weight of the iron is assumed to be 7.7 for ordinary dynamo sheet and 7.5 for special alloy-steel sheets. Standard thicknesses of sheets are 0.3, 0.5 and 0.8 mm. To determine the loss figure the apparatus of Epstein is used. For the magnetic tests ballistic methods or the apparatus of Koepsel is employed.—*Elek. Zeit.,* May 19.

Elasticity of Platinum-Iridium Wires.—K. E. GUTHE AND L. P. SIEG.—An account of an experimental investigation on the elastic properties of platinum-iridium wires when used for suspension. Platinum-iridium wires containing over 30 per cent iridium show striking peculiarities in their elastic behavior, which becomes the more marked the higher the percentage of iridium. For small amplitudes the period or torsional vibration is nearly proportional to the amplitude, but for larger amplitudes the rate of increase of the period becomes smaller, and for very large amplitudes the period tends toward a constant value. The logarithmic decrement increases with the amplitude, reaches a maximum, after which it again decreases and probably reaches a minimum for very large amplitudes. The maximum is the more pronounced the larger the original distortion. If the wire has been allowed to rest some time before the torsional vibrations are produced, the total number of vibrations necessary to bring the system to rest is smaller the larger the initial amplitude. When tested by the static method the wires closely obey Hooke's law. The torsional moment calculated from the static experiment is larger than the largest torsional moment found by the dynamic method.—*Phys. Rev.,* May.

Testing Set.—An illustrated description of a new universal testing set of English make for the use of wiremen. The essential parts of the set comprise a direct-reading microammeter capable of being connected across a universal shunt, a series resistor for use when measuring pressures and insulations, two resistors of low resistance for use when measuring millivolts, also a resistor of resistance equivalent to that of the universal shunt which is substituted for it when measuring millivolts. Two standard shunts, having their resistances adjusted to decimal parts of an ohm, are used for measuring currents by the drop at their potential points, which is read at the millivoltmeter terminals.—Lond. *Electrician,* May 20.

Meter Tests.—A set of regulations prepared by committees of the German Association of Electrical Engineers and of the

Association of German Electricity Works on the conditions which electric meters must fulfill to be admitted to official tests.—*Elek. Zeit.*, May 19.

Weston Standard Cell.—G. A. Hulett.—A note on the cathode equilibrium in the Weston standard cell.—*Phys. Rev.*, May.

Telegraphy, Telephony and Signals.

Telephone Relay.—P. R. Coursey.—With reference to S. G. Brown's recent paper on a telephone relay the writer describes some experiments which seem to be analogous to the effects of Brown's microphonic contact. He used a modification of the "wheel coherer" in the form of a very fine steel needle mounted on a vertical adjustment screw, and so arranged that its point was capable of dipping into a cup of mercury placed underneath. The surface of the mercury was covered with a layer of oil, and the apparatus was connected up to a telephone receiver and a pair of dry cells fitted with a reversing switch. In Fig. 4, *A* represents the steel-mercury combination, *T* the telephone and *S* the two-way reversing switch. On screwing down the steel point it was found that the steel apparently pierced the surface of the mercury for quite an appreciable distance before there was any current through the telephone receiver, due to the presence of a thin film of oil—the current could, of course, at once be detected by breaking the circuit. If now the switch *S* were left on the right-hand contact—that is, with the steel negative—it was found that, with the steel adjusted as above, whereas there was no current at first, a weak one very soon started and gradually increased in value till there was quite a loud click in the telephone on breaking the circuit. It was discovered that the arrangement was very sensitive to movement of the steel, and that very large fluctuations in current followed minute variations in the position of the steel. When, however, the switch was thrown over to the left, so as to make the steel positive, the effect entirely disappeared. Ordinary glycerine oil seems to be best.—Lond. *Electrician*, May 20.

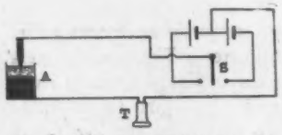


Fig. 4—Diagram Showing Principle of Telephone Relay.

Telephone Circuits.—J. Perry.—A (Brit.) Phys. Soc'y paper in which the author gives an easy method of calculation for the spacing of Pupin coils. This method gives a result practically correct. The author's analysis refers to the most general case in which similar contrivances (resistors, inductance coils, leakages, condensers) are placed at equi-distant points along the line and it is shown how to calculate the effect of placing any kind of contrivance at such equi-distant points.—Lond. *Electrician*, May 20.

Wireless Telegraphy.—Count Arco.—A paper illustrated by diagrams describing various new devices and apparatus which he showed in a recent lecture on the new wireless telegraph system of the Telefunken Company. Among them is a mechanical apparatus for demonstrating sounds and noises, and a device for demonstrating at the same time acoustically a sound and optically the regularity of the spark discharge. A sending station of 8-kw primary power is described; the power at the antenna is 5.8 kw, hence the efficiency 72.5 per cent. Duplex wireless telegraphy is possible with two transmitters of equal wave-length, the pitches differing by 20 per cent. At the receiving end a single detector receives simultaneously the two messages, the currents received passing through the two series-connected primaries of two resonators tuned to the sounds with the two pitches. One resonator increases the sound of the one transmitter and the other the sound of the other transmitter.—*Elek. Zeit.*, May 19.

Protection of Telephone Circuits Against Disturbances from Alternating-Current Traction Systems.—A note on a recent British patent of J. Sayers (15,158, 1909; May 12, 1910). Both electrostatic and electromagnetic induction are neutralized by providing an auxiliary insulated conductor parallel to the trolley wires and the telegraph or telephone wires to be protected. In the case of a double-line railway with a trolley wire over each track, two insulated wires run parallel to the trolley wires and are connected at both ends so as to form a closed circuit. At the point where current is fed into the trolley wires, the auxiliary circuit is connected to one pole of a small alternating-current generator, which charges it at the same frequency as that of the system, but at a lower pressure and 180 degrees out of time-phase. The other pole of this generator is earthed. In order to neutralize farther the electromagnetic induction the auxiliary circuit includes the secondary coil of a transformer, the primary of which is connected to the secondary of another transformer, the primary of the second transformer being in series with the main trolley-wire circuit. By this means a low-pressure current proportional to the main traction current, but 180 deg. out of time-phase with it, circulates in the auxiliary circuit.—Lond. *Elec. Eng'ing*, May 19.

Book Reviews

Miscellaneous Tests of Electric Car Equipment. Eugene C. Parham and John C. Shedd. New York: McGraw-Hill Book Company. 166 pages, 74 illustrations. Price, $1.

The present work is virtually a second volume of a treatise on car testing, the first volume of which appeared a few years ago under the title "Shop Tests on Electric Car Equipment." The book is written especially for railroad employees who have tests to make and wish to know just how to go about the work. The scheme of treatment is similar to that used in the previous volume—that is, a short description of the test is given, followed by concise minute directions for carrying it out, then suggestions and remarks follow the directions giving useful information which has bearing on the case, but if included in the foregoing development of the test would detract from the clearness of the directions for making the test. The tests cover mechanical and electrical shop tests of equipment, and tests of cars in operation. The authors divide the book into two sections: one entitled "Stationary Tests" and the other "Motion Tests." The power consumption tests of cars in operation are accompanied by sample data sheets and instructions for working up the data. At the end of the book are printed directions for resuscitation from electric shock and a list of review questions.

Fields of Force. A Course of Lectures in Mathematical Physics Delivered Dec. 1 to 23, 1905, at Columbia University by Prof. V. F. K. Bjerknes, of Stockholm University. Publication No. 1 of the Ernest Kempton Adams Fund for Physical Research. New York: The Columbia University Press. Quarto, 136 pages.

In this series of lectures, which has evidently been carefully edited, Professor Bjerknes analyzes certain hydrodynamic fields of force that are produced experimentally in water by a suitable mechanically oscillating system. He shows experimentally that the fields of disturbance so created in the water bear marked topographical analogies to corresponding electric and magnetic fields in free space. He then analyzes electric and magnetic fields mathematically by vector methods, following the leadership of Maxwell and Heaviside. He next proceeds to analyze mathematically the fields of hydrodynamic disturbance that theoretically present themselves in the likeness of his experimental fields of oscillatory disturbance in water. A large amount of this investigation is new. On comparing the mathematics of the electromagnetic field with the mathematics of the hydrodynamic field, certain resemblances or analogies present themselves; electric flux corresponds to fluid velocity, electric intensity to specific momentum, and so on. It is shown, however, that this does not necessarily mean that electric flux is a fluid velocity. The analogy may be merely casual. The

threshold only of the subject is entered. Incidentally, an excellent appendix is added on vector notation and formula.

HYDRAULIC ELEVATORS. Their Design, Construction, Operation, Care and Management. William Baxter, Jr. New York: McGraw-Hill Book Company. 324 pages, 260 illustrations. Price, $2.50.

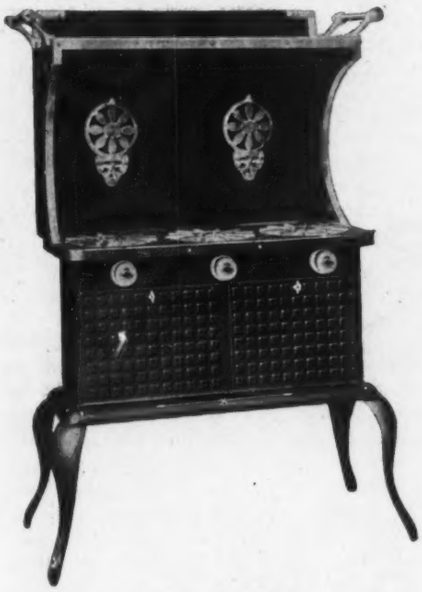
This book treats the construction, care and operation of different types of hydraulic elevator machines. The principles of the different types of reduction gearing, counterbalances, control systems are all described in detail and explained with the aid of simple diagrams. The question of pumps and motive power is not touched upon, therefore little space is devoted to electricity. However, one chapter is given up to the description of an electrically controlled hydraulic elevator in which the car is controlled by push bottons located on different floors.

For those desiring to familiarize themselves with the principles of hydraulic elevators and those who are called upon to operate or supervise the operation of them, the book should prove of great value. The subtitle "Design" is somewhat misleading, as this book could scarcely be recommended to designers as more than a reference book.

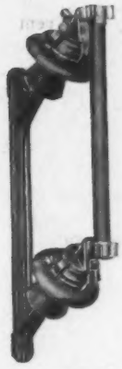
New Apparatus and Appliances

ELECTRIC COOK STOVE.

The Hughes Electric Heating Company, 226 West Superior Street, Chicago, Ill., has placed on the market an electric cookstove which resembles an ordinary gas or gasoline stove, and is equally as cheap in first cost. It is provided with steel body and legs, stands wherever placed and can be moved at will. It is so built that the housewife can do with it all kinds of cooking, baking and other work required of a kitchen stove.



Electric Cook Stove.



Fuse-Switch.

The heat is under absolute control. The stove is so constructed that by three temperatures, low, medium and high can be obtained, the consumption being 100 watts, 300 watts and 600 watts respectively. The heating elements are removable and can be renewed by the consumer and installed by him without the slightest difficulty.

HIGH-TENSION WEATHERPROOF FUSE AND DISCONNECTING SWITCH.

With the increasing size of central-station distribution systems it is rapidly becoming recognized as good engineering practice to install disconnecting switches at such points as to isolate the various feeders or important transformer installations. To meet these new conditions numerous weatherproof switches have been developed, but the majority simply furnish a means for disconnecting the circuits without affording protection against overloads or short-circuits. Under these conditions it is therefore necessary to install also fuses or circuit-breakers at the transformers, or other points of the circuit to be protected.

A solution of the conditions imposed by modern practice is offered in the combined weatherproof fuse and disconnecting switch shown in the accompanying illustration, which has been placed on the market recently. The line conductors are soldered directly to heavy detachable connectors arranged to be fastened to terminal plates, which in turn support a pair of special contact jaws for reception of the fuse chamber.

The supporting element is made of iron so treated as to resist weather conditions and of sufficient mechanical strength to minimize danger of breakage during installation. At each end of the supporting frame is located a slot to permit the insertion of lag screws to attach the device to cross-arms, poles, or walls.

On two projecting pins are mounted a pair of petticoat high-tension insulators having great mechanical strength and high insulating qualities. The design and dimensions of the insulators are such that the standard maximum surface or creepage distance is secured and the factor of safety is then doubled by employing designs for double the actual line voltage or test conditions. For example, a 13,200-volt device is equipped with insulators tested for 25,000-volt line pressure and 70,000-volt breakdown test.

Fastened at the top of each insulator is a specially designed locking contact device of such contour that the weatherproof fuse chamber can be inserted in the usual manner. The construction is such that a blown fuse can easily be replaced by the use of insulating tongs, or when desired the entire element can be swung open as a disconnecting switch, thus effectually isolating an entire section of line.

The fuse is of the enclosed type and specially constructed to resist weather conditions. The construction is such that the blowing time is practically constant under varying temperature, so that transformers or other apparatus can be thoroughly protected by using proper size of fuses. Arrangements have been made to insure rapid condensation of the expanding gases generated by volatilization of the metal during the fuse period and to break up their continuity. This rapid cooling and absorbing, or dissipation, of these gases are of the highest importance, and the result is a fuse which will not only meet the difficult conditions imposed by outdoor service, but will also quickly suppress and prevent holding over of the heavy arc incident to short circuits and overloads.

Rapid lowering of the gas temperature to a point where their conducting property decreases to zero is also of great importance in preventing danger of explosions which would tend to strain or even destroy the fuse casings.

A complete line has been developed for the various commercial voltages, the ampere limits at present being as follows: 2200 volts, 200 amp; 3300 volts, 150 amp; 6600 volts, 30 amp; 13,200 volts, 20 amp; 22,000 volts, 6 amp.

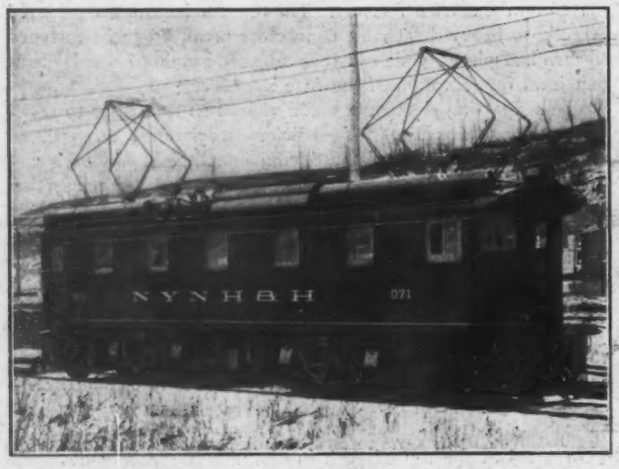
The spacing distance between contacts conforms to recognized commercial practice, thus eliminating the danger of leakage under operating conditions, or the danger to the lineman during installation or inspection. The device here described is manufactured by the Delta-Star Electric Company, of Chicago, Ill.

TESTS OF SINGLE-PHASE LOCOMOTIVE.

The accompanying illustration shows a 150-ton, single-phase locomotive recently built for use on the electrified section of the New York, New Haven & Hartford Railroad between Stamford and New York City. The entire electrical equipment, including the spring drive of the motors, is the design of the Westinghouse Electric & Manufacturing Company, while the mechanical parts were designed by the engineers of the Baldwin Locomotive Works and the New Haven Railroad Company.

The specifications required that the locomotive be able to haul a 1500-ton freight train at a speed of 35 miles an hour on level track, where the train resistance is not over 6 lb. per ton. They also required that the locomotive be capable of hauling an 800-ton passenger train at a speed of 45 miles an hour.

That the locomotive is a success has been demonstrated by frequent tests made under severe operating conditions. Besides proving itself in other ways, it has hauled 37 loaded cars, a heavy freight engine and a caboose from New Rochelle to Stamford, a distance of 18 miles, in 27 minutes. Although this run was made in a drizzling rain that froze as fast as it fell and made the tracks very slippery, the engine attained a speed



Single-Phase Locomotive.

of 49 miles an hour. During some tests made at the works of the Westinghouse company, at East Pittsburgh, Pa., the locomotive started and accelerated a 2100-ton freight train, both on level track and on an up-grade of 0.3 per cent on a 3 deg. curve. A train corresponding to the 800-ton passenger train was accelerated at a rate of about 0.4 mile per hour per second and quickly reached the required speed. For hauling trains the new locomotive has about twice the rating of any one of the locomotives already in use on the New Haven railroad. Each motor has a one-hour rating of about 375 hp, and a continuous rating of approximately 310 hp. The tests made have shown that the locomotive has a good margin over the specifications.

The design of the trucks and running gear of the locomotive is unique. The truck frames are connected by an intermediate draw-bar. One truck has only a rotative motion about its center-pin, while the other has a fore-and-aft, as well as a rotative motion, in order to compensate for the angular positions of the trucks and draw-bar when the locomotive is traversing a curve. The tractive force is transmitted through the truck frames and draw-bar instead of through the main frame. Each truck has two pairs of driving wheels and a single pair of leading wheels. The wheel loads are equalized as in steam-locomotive practice. To assist in reducing shocks and keeping the two trucks in alignment, chafing castings and spring buffers are interposed between the truck frames, under the center of the locomotive. The weight of the cab, instead of being carried on the center pin, is carried on friction plates at the ends of the truck. The weight is applied through springs, which have a considerable latitude for motion to allow for variation in the track without changing materially the distribution of weight on the ends of the truck. The plan of running-gear and cab support adopted for this locomotive prevents any periodic vibration or "nosing," minimizes shocks on the truck and roadbed, and insures easy riding.

The electrical equipment comprises four single-phase geared motors, together with the auxiliary apparatus necessary for their operation from the 11,000-volt alternating-current or 600-volt direct-current circuits of the electrified sections of the New Haven and the New York Central railroads, respectively. The motors are of the same general electrical design as those in use on the present New Haven locomotives.

Each motor is rigidly mounted on the truck frame and directly above a quill surrounding the driving axle, to which it is geared. The motors project into the cab, and the floor above them is raised. This method of mounting the motors on the truck frame gives a high center of gravity and prevents the transmission of strains and shocks from the track and roadbed to the motors.

An air-blast transformer is provided for lowering the trolley-line voltage to that required by the motors. The control apparatus is of the electro-pneumatic type.

When operating on alternating current all four motors are connected in multiple, and the control is obtained by changing the connections to various voltage taps on the main transformer. On direct current the motors are first grouped all in series, and then two in series and two in parallel, in combination with various resistance steps. Provision is made for cutting out any one of the four motors singly on either alternating current or direct current. A master controller and brake valve are located in each end of the cab so that the locomotive can be operated from either end, and the system of control is such that the two or more locomotives can be coupled together and operated from one master controller.

Two pneumatically operated pantograph trolleys are provided for collecting current from the 11,000-volt alternating-current line. Pneumatically operated third-rail shoes are used to collect current on the direct-current third-rail section.

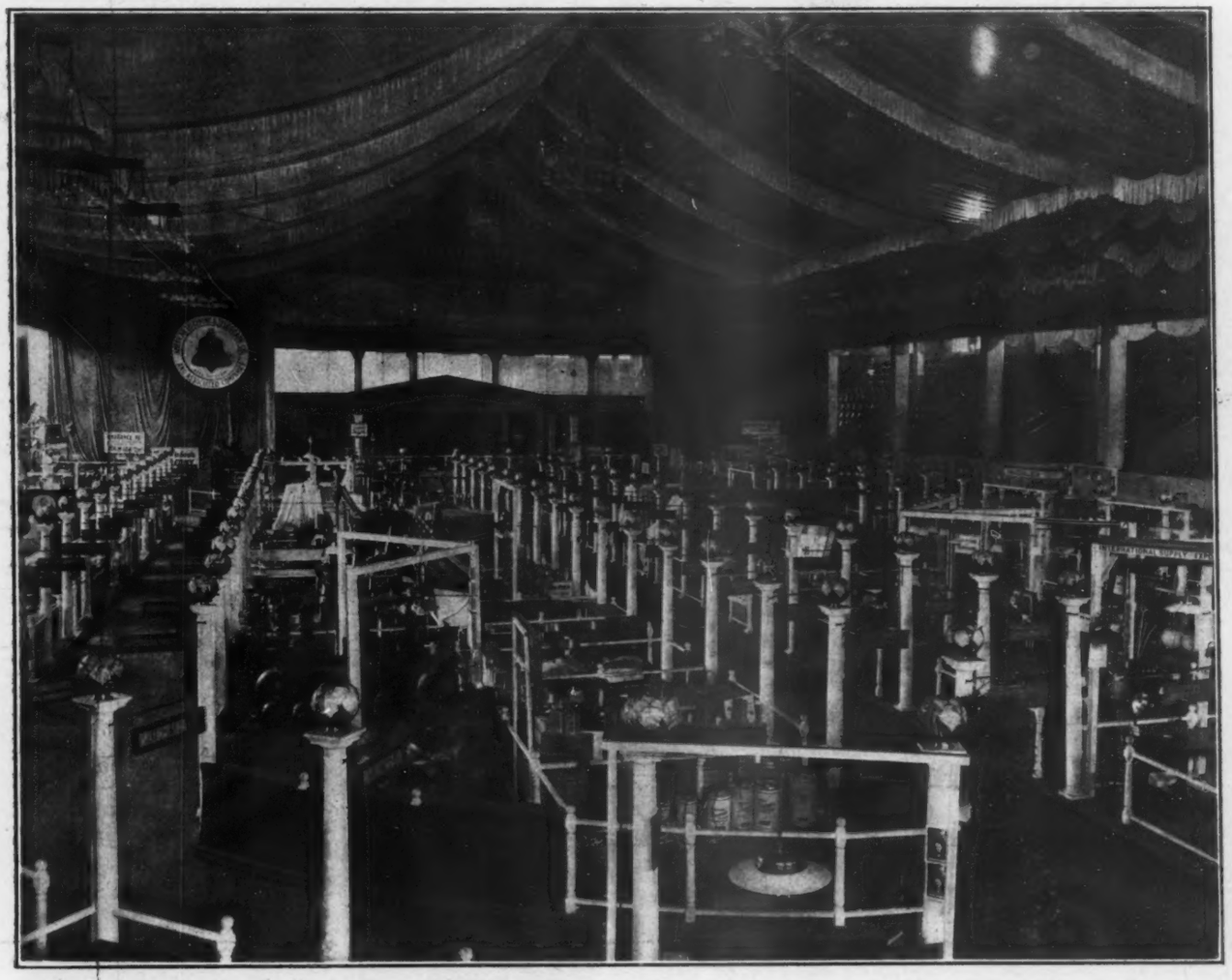
ST. LOUIS ELECTRICAL SHOW.

The first electrical show ever given in St. Louis was held in the Coliseum, May 28 to June 2, under the auspices of the St. Louis League of Electrical Interests. The show was conducted on a co-operative basis, the expense and profit being shared pro rata among the various exhibitors. Following directly on the heels of the exhibit made by the Class D members of the National Electric Light Association, the entire decorative scheme and booths employed by the later were retained, and the majority of the exhibitors at the N. E. L. A. convention kept their booths and displays for the following week as well. Additional booths were erected in the front of the hall, and the stage was devoted to an exhibit of the Union Electric Light & Power Company, an account of which appears elsewhere in this issue. Exhibits were also made in the space beneath the seats outside of the arena proper.

A feature of the show, outside the display made by the local electric light company, was the exhibit made by the local railway company, the United Railways Company, which showed a model of the latest type of steel car now used in St. Louis. Every working section of the car was open to view. A motorman and conductor were stationed on the car, one side of which was removed to enable the public to see how the air brakes, lightning arrester, fuse box, automatic circuit-breaker and emergency brakes worked. The truck was raised from the ground so as to permit the wheels to revolve. The evolution of the street car was shown pictorially from the first car built by Stephenson in 1832 to the latest type used in St. Louis.

The majority of the exhibits made at the show were identical with those made at the N. E. L. A. convention the week before, and were described in the issue of May 27. The additional booths were occupied almost without exception by local con-

cerns who exhibited electrical appliances contributing to the utilities and enjoyment of life in present-day civilized communties. The list of exhibitors was as follows: Automatic Electric Washer Company, Newton, Ia.; Allis-Chalmers Company; Frank Adam Electric Company, St. Louis, Mo.; Auto Maintenance & Manufacturing Company, Chicago, Ill.; Auto Vacuum Cleaner, Bloomington, Ill.; American Washer Company, St. Louis, Mo.; C. F. & J. R. Brown, St. Louis, Mo.; C. J. & F. E. Briner, St. Louis, Mo.; Baker Motor Vehicle Company, Cleveland, Ohio; Brilliant Sign Company, St. Louis, Mo.; Bell Telephone Company, St. Louis, Mo.; Columbus Buggy Company, Columbus, Ohio; Century Electric Company, St. Louis, Mo.; Commercial Electrical Supply Company, St. Louis, Mo.; Corby Supply Company, St. Louis, Mo.; Columbia Phonograph Company, St. Louis, Mo.; Columbia Meter Company, Indianapolis, Ind.; Dielectric Manufacturing Company, St. Louis, Mo.; Department of Electrical Engineering, Washington University, St. Louis, Mo.; Economical Electric Lamp Company, New York; *Electrical World*, New York; Edison Storage Battery Company, Orange, N. J.; Excello Arc Lamp Company, New York; *Electric St. Louis Magazine*, St. Louis, Mo.; Electric Storage Battery Company, Philadelphia, Pa.; Ft. Wayne Electric Works, Ft. Wayne, Ind.; Federal Electric Company, Chicago, Ill.; General Electric Company; General Vehicle Company, Long Island City, N. Y.; General Compressed Air & Vacuum Machinery Company, St. Louis, Mo.; Gleeson-Brokaw Electric Company, St. Louis, Mo.; H. H. Humphrey, St. Louis, Mo.; John Hague, St. Louis, Mo.; Heine Safety Boiler Company, St. Louis, Mo.; Imperial Manufacturing Company, Independence, Kan.; International Supply & Export Company, St. Louis, Mo.; H. W. Johns-Manville Company, New York; Laclede Gas Light Company, St. Louis, Mo.; Moloney Electric Company, St. Louis, Mo.; W. N. Matthews & Brother, St. Louis, Mo.; Mermod-Jaccard-King Jewelry Company, St. Louis, Mo.; F. E. Newbery Electric Company, St. Louis, Mo.; National Electric Lamp Association, Cleveland, Ohio; National Metal Molding Company, Pittsburgh, Pa.; National Clock & Electric Manufacturing Company, St. Louis, Mo.; Otis Elevator Company, Yonkers, N. Y.; Ralph Owen, Springfield, Ill.; *Popular Electricity*, Chicago, Ill.; Perfection Vacuum Cleaner Company, Chicago, Ill.; Perfect Arc Light Company, St. Louis, Mo.; Phœnix Auto Supply Company, St. Louis, Mo.; Rauch & Lang Carriage Company, Cleveland, Ohio; Reeves & Skinner Machine Company, St. Louis, Mo.; Studebaker Automobile Company, South Bend, Ind.; Simplex Electric Heating Company, Cambridge, Mass.; Standard Underground Cable Company, Pittsburgh, Pa.; Sangamo Electric Company, Springfield, Ill.; St. Louis Electric Heating Company, St. Louis, Mo.; St. Louis Brass Manufacturing Company, St. Louis, Mo.; Stolz Electrophone Company, St. Louis, Mo.; Charles J. Sutter, St. Louis, Mo.; Sefton Company, St. Louis, Mo.; Santo Sales & Rental Company, St. Louis, Mo.; Scruggs-Vandervoort-Barney Dry Goods Company, St. Louis, Mo.; Tungstolier Company, Cleveland, Ohio; Trorlicht-Duncker Carpet Company, St. Louis, Mo.; Union Electric Light & Power Company, St. Louis, Mo.; United Electric & Supply Company, St. Louis, Mo.; United Railways Company, St. Louis, Mo.; E. C. Van Nort Electric Company, St. Louis, Mo.; Wesco Supply Company, St. Louis, Mo.; The Waverley Company, Indianapolis, Ind.; Wagner Electric Manufacturing Company, St. Louis, Mo.; Westinghouse Electric & Manufacturing Company; George W. Witmer, New York; and the Western Electric Company.



General View of St. Louis Electrical Show.

FIRELESS COOKER WITH ELECTRIC STOVE.

A combination of the ordinary electric heater with a fireless cooker is illustrated herewith. The apparatus is built by the A. L. Sykes Manufacturing Company, of Cincinnati, Ohio, and is known as the "Quad" fireless cooker because it possesses four compartments. As is well known, a device of this kind cooks chiefly by means of the latent or stored heat in the food itself. Ordinarily, after being brought to a boil, the food, in proper

Fireless Cooker with Electric Stove.

dishes, is introduced into an insulated receptacle. There it is cooked in its own heat, which is unable to escape or to radiate. In the Quad cooker the process of baking, boiling, roasting or stewing the food is started by an electric stove placed in the bottom of the device. The dishes or compartments for holding the food are of aluminum and fit one on top of the other, while over all is a snugly-fitting insulating hood fastened at the bottom to the portion holding the electric stove. The arrangement is quite compact and efficient, and by its use one can employ electricity for cooking meals which are not only palatable, but can be prepared in this manner without danger of burning or scorching and at less cost than meals cooked in the ordinary way. The apparatus being a thorough insulator of heat or cold can be employed for many other purposes, such as, for instance, in keeping things originally cold in that condition for a great length of time. Its chief merit, however, lies in the application of electricity to a fireless cooker, whereby the expense hitherto attached to the preparation of meals by electricity is very greatly reduced without in any way affecting the finished product.

CENTRAL-STATION APPLIANCE EXHIBIT IN PROVIDENCE.

One of the most diversified central-station exhibits in New England is maintained in comparatively limited office building quarters by the Narragansett Electric Lighting Company, of Providence, R. I. The company's headquarters are located in the Union Trust Building, one of the most complete and modern structures of its kind in the city, and in the heart of the retail business district. The offices are located up one flight from the street, and the appliance exhibit is installed close by the billing and receiving division where customers who call in person transact the bulk of their business with the company.

Fig. 1 shows the general arrangement of the appliance exhibit, which is designed to emphasize the domestic and smaller industrial services of electricity, including typical displays of tungsten lamps, ornamental shades, decorative plants with electrically illuminated blossoms and buds, household heating apparatus and small motors. The ceiling beams are pressed into service to illustrate the brilliancy of different styles of incandescent lamps, and appropriate printed signs are installed beneath electrically illuminated sign equipment showing the economy of the tungsten lamp over the old carbon filament. The electric heating equipment is in the main carried on special tables covered with bevelled plate glass 0.25 in. thick and fitted with outlets and wiring to enable the apparatus to be demonstrated in a flexible manner. The bevelled plates cost nearly $30 apiece, but were used to preclude any accidents which might result from the close association of the public with the tables and their equipment. The use of the plate glass permits the enjoyment of hospital standards of cleanliness when cooking demonstrations are in order. As noted in a recent issue of this paper, the windows of the company's office are lettered with signs giving in succinct form the advantages of electric motor and lighting service, and recently large reflectors with tungsten lamps have been installed inside the office at the tops of the windows to throw light downward and bring the lettering into greater prominence from the street level.

The space formerly occupied by several windows in the interior of the building has been closed in and a recessed background formed for the display of art shades on suitable shelves. Outlets near the bottom of the recess permit the convenient operation of any fixture or shade which may be exhibited and enables a large number of shades to be shown as desired without requiring much valuable floor or wall space. In some cases artificial flowers are displayed in these recesses to considerable advantage.

An interesting feature of the company's exhibit is its practice in labelling apparatus with signs giving complete cost and operating data for the benefit of the visitor. Thus, on an electrically driven house pumping tank, shown at the right in Fig. 1, the first cost under different conditions is inscribed on the glass side of the tank, and above these figures are shown the rating of the apparatus and the operating cost for a given period at Narragansett rates for energy. The same plan is carried out with respect to the marking of galvanized iron tanks used in vacuum cleaning equipment, ice-cream freezers, kitchen utensils, etc. A Brunswick refrigerating machine is

Fig. 1—Appliance Exhibit.

installed in the exhibit, and this is operated with three compartments, making all the ice used daily in the office and sometimes being employed in freezing ice cream, etc. The doors of this equipment are glassed over so that the reading of the thermometer and the details of automatic operation can be seen by the visitor. The cost of running this plant under specified conditions is also given.

Fig. 2 shows the company's small motor exhibit, only a few of the machines kept in stock being displayed for lack of

space. The motors now shown range in rating from 0.03 hp to 1 hp, in both direct-current and alternating-current types, including machine-tool equipments for directly-connected service, drills, grinders, buffers, dental, surgical, sewing machine and other industrial and domestic appliances. The company carries a stock of motors at all times, worth about $25,000, to facilitate immediate installations.

The company's practices in its sales department were described in this paper in connection with Mr. E. R. Davenport's paper before the New England section of the National Electric Light Association, abstracted in these columns March 24, page 734. Fig. 3 shows a group of electrically operated domestic appliances, with a meat-chopper labelled as to rating and operating cost. On the Narragansett rates 35 lb. of beef can be cut in less than six minutes at a cost of 1 cent. A display of electric flatirons ranging from 3 lb. to 20 lb. is on exhibition, and among the novelties is a kitchen outfit equipped with a 0.25-hp motor which will run any two pieces of apparatus at once by a suitable mechanical coupling, based on the universal joint principle. This includes an ice-cream freeezer, butter-churn, egg-beater, juice-extractor, meat-grinder, coffee-grinder, potato-parer, and dough-mixer. Various electric ranges and water heaters are also shown. The prices charged for the rental of decorative electric plants are, per day of 24 hours, $1.50 for one plant; $1.25 each for two; and $1 each for three or more. These, with electrically operated "endless chain" illuminated fountains, have found considerable favor during the past winter at banquets in Providence, quite an extensive display having been arranged at the recent visit of President Taft.

In a previous issue of this paper reference was made to an exhibit in this department of an ammeter with a scale graduated to read the operating cost of various incandescent lamps in cents per hour at the company's standard rates. The wiring permitted the switching of various sizes of lamps into circuit, and the ammeter showed the cost, a watt-hour meter being used also to illustrate the effect of the load upon the meter reading. The same general plan has been carried out in connection with the measurement of motor load. The exhibit consists of a 1-hp motor fitted with a leather friction brake which can be pressed against the pulley by a treadle, a watt-hour meter with glass case, starting box, fuses, switches, and ammeter reading in cents per kw-hour. By varying the pressure of the foot upon the treadle the energy consumption of the motor is varied, and the ammeter and watt-hour meter indicate the effect in a most striking way. The scale of the ammeter is graduated according to the base rate of 10 cents per kw-hour, and with the exhibit the customer can be shown the creeping of the meter which results from leaving the main switch closed, the energy consumption required when

Fig. 2—Electric Motor Exhibit.

the motor is run at no load, and the effect of sudden or gradual applications of the brake.

The company advertises in the local newspapers twice weekly, changing the copy each time. Illustrations are also used to make the copy attractive. During the month of January last special advertising was done in connection with the tungsten lamp, and it was found that nearly every one purchasing the lamps at the office at that time referred to the advertising. The backs of the customers' bills are utilized each month for advertising some proposition. An endeavor is made each month to break the monotony by using different colored inks and having sketches prepared by a local artist, or else using a cut of the appliance referred to. Booklets are issued from time to time as occasion requires, and fliers are inserted each month with all bills. The company has lately arranged to use envelopes booming Providence as an industrial center, with the words "Cheap Power" conspicuously printed on the back. At a scenic theater pictures were recently shown of an electrically

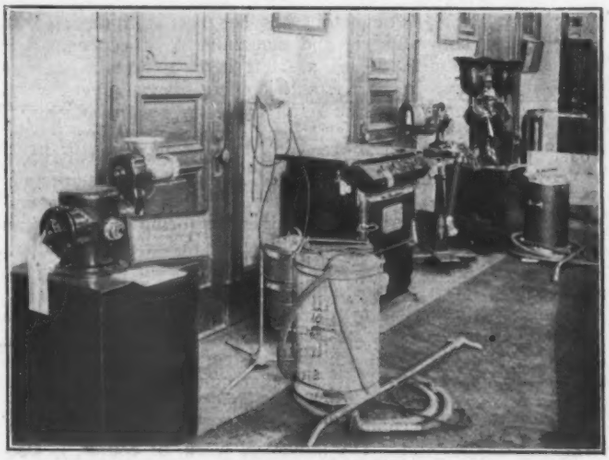


Fig. 3—Electrically Driven Domestic Appliances.

operated dough-mixer, pie-filler and cake-machine. Prominently displayed in the department is a glass-covered bulletin board with sliding tabs showing the customer the particular devices which are featured for free trial during the current month. An information bureau for inquiries regarding electrical matters is included in the department.

Every endeavor is made by the company to co-operate with the contractors. Monthly meetings are held at which all the trade are welcomed. The members of the sales department invite different individuals, thereby dropping all formality and making the occasion personal. Each member is at the door on the evening of the meetings, ready to greet each guest invited by him as he enters. Everybody is made to feel at home. These meetings are always addressed by some representative of the manufacturers secured to talk on matters of interest. Recent subjects have been the induction motor and the flaming-arc lamp, the speaker in each instance being an authority on the subject. The meetings usually close with a discussion and afterward light refreshments are served. The seating capacity is frequently taxed to its limits. The company does no wiring of any kind, not even on its own work. The latter is given out to local contractors. The work is distributed as much as possible, and the result is that the contractor likes to tell his customers that he does work for the lighting company, believing that to be a great recommendation. The company tries not to compete with the contractors on the sale of anything, and often turns over sales to them. The work of the department is under the direction of Mr. E. R. Davenport, sales manager, who is responsible to Mr. A. B. Lisle, the general manager of the company.

LARGE CAPACITY TIME SWITCH.

In an article in the issue of May 19, entitled "Large Capacity Time Switch," it is stated that the switch is made by the Hartford Time Switch Company, Hartford, Conn. Instead of Hartford, the address should have been 97 Warren Street, New York, the Hartford Time Switch Company having moved its plant from Hartford more than two years ago. The switch of large capacity described, it may be noted, is a development of former designs, but embodying improvements which make possible the handling of heavier currents.

Industrial and Commercial News

The Week in Trade.

UNSEASONABLY cold weather throughout the entire northern portion of the country was held responsible last week for again checking trade development. Although the actual damage to crops has not been reported as being severe, both planting and maturing have been considerably retarded, and producers are left in an uncertain state of mind which prevents them from becoming liberal buyers. The reports, therefore, from the retail trade are to the effect that business is decidedly unsatisfactory. Except on the Pacific Coast and in Texas, there is little being done. This condition, of course, is reacting upon wholesale business. Orders are very few and are ragged. They are mainly for quick delivery and small quantities. Very little business is being done in fall goods. The condition of uncertainty and the semi-demoralization which exists in the securities market, based upon the adverse action taken by the administration with regard to railroad rates, is reflected in all lines of business. There is a hesitancy everywhere among large corporations to make heavy contracts, and one great railroad system cancelled last week orders already placed. It is said that quite a number of contracts for cars and for other equipment have been held up until a more settled condition is presented to the managers of large railroad systems. The industrial work, of course, is also feeling the effect of this unrest. While the iron and steel mills are still busy, it is recognized that the cancellation of orders may at any moment compel a curtailment of activities. The best reports come from the building industry and outdoor construction. Building is especially active at this time, and a better class of construction is noted in the returns. Orders for agricultural implements are somewhat less, the season being practically over for heavy purchases. Commodity prices declined notably within the past week, and it is believed that our export business will soon begin to improve in an encouraging manner. Collections are particularly unsatisfactory, as would necessarily be the case when retail trade is not good, and there is uncertainty as to the future. Business failures for the week which ended June 2, as reported by *Bradstreet*, were 160, as against 200 for the previous week, 191 for the same week in 1909, 225 in 1908, 155 in 1907 and 162 in 1906.

The Copper Market.

EXPORTS of copper in May were not as large as had been anticipated. According to the returns furnished by the Metal Exchange, the exports from Atlantic ports were about 47,000,000 lb. During the first five days in June exports were smaller than during the same five days in May. It is therefore apparent that the report of the Copper Producers' Association will probably show total exports of only about 45,000,000 lb. Deliveries into domestic consumption will also show a decrease from those in April. They will probably not amount to more than 65,000,000 lb. Thus the total deliveries for the month of May are estimated to be about 110,000,000 lb. Production, on the other hand, has continued at a record-breaking rate. It is likely that the total for the month will amount to 125,000,000 lb., which indicates an increase in the surplus stocks of 15,000,000 lb. During the past week there has been very little buying, either in this country or in Europe. Although reports indicate that there has been a slight increase in the consumption of copper abroad, it appears that reserve stocks have been drawn upon rather than new metal. Early in the past week prices were held a trifle stiffer, and buyers both at home and abroad were compelled to pay fractionally higher figures. Toward the end of the week there was more pressure to sell and rates were lower. The speculative demand abroad amounts to very little, and the visible supply of metal is very slightly reduced. It is estimated that the visible supply in Europe May 31 amounted to 239,271,320 lb. This is an increase over the same period last year of almost 8,000,000. Exports for June, including June 6, were 2192 tons. The daily call on the Metal Exchange June 6 quoted standard copper as per the accompanying table.

Standard Copper.	Bid.	Asked.	Settling price.
Spot	12.50	12.55	.....
June	12.35	12.50	12.45
July	12.35	12.50	12.42½
August	12.35	12.50	12.42½
September	.....	.....	.....

The London market, June 6, was as follows:

	Noon. £	s	d	Close. £	s	d
Standard Copper, spot	56	6	3	56	6	3
Standard copper, futures	57	2	6	57	2	6

Extreme fluctuations for this year:

	Highest.	Lowest
Standard	13.50c	12.05c
London, spot	£62 0 0	£55 2 6
London, futures	65 18 9	56 2 6
Best selected	65 10 0	59 10 0

Industrial and Commercial Notes.

Colorado Hydroelectric Development.—Announcement has been made in Denver that, backed by Boston and foreign capital, a plan is on foot for the irrigation of 200,000 acres of land near the city, and for supplying energy to the amount of 37,000 hp. There have recently been incorporated two companies with a capitalization of $2,000,000 each, known as the Boston-Colorado Power Company and the Park Irrigation & Water Company. There is shortly to be incorporated a third company to be known as the Consolidated Construction Company, which will be the holding company for the other two, and which will be capitalized at $1,000,000. It is said that the two companies already organized have sold bonds to the amount of $5,000,000, and the money is now available for construction work, which will be done by the Consolidated company. The interests represented in these enterprises have acquired a large number of water rights in the vicinity of Boulder, Colo., amounting to about 25,000 acre-ft. of water, and a power house with 30,000-hp capacity will be built at Glendall. The men behind the enterprises are: F. B. Cheesbro, of Boston, president of the Cheesbro Steamship Company; Dr. C. F. Underhill, of Grayling, Mich., organizer of the Heinze Copper Company and the Oldsmobile Company; H. G. Alexander, vice-president of the Capitol National Bank, Denver; Thomas E. Bartlett, of the Continental Trust Company; W. T. Dieter, of the German-American Bank; H. A. Hicks, Guy Harrison and F. W. Fugate, all of Denver.

Toronto Terminal and Subway.—It is likely that a proposition will shortly be made to the city for a 25 or 50-year franchise by A. P. Gillies, of New York, who is the active head of a company organized with a capital of $25,000,000 for the purpose of constructing a terminal railway system with subway approaches. Mr. Gillies was in Toronto last week conferring with Dr. C. R. Clarkson and R. L. Cowan, of Toronto, and M. I. Stewart, of British Columbia, who are also interested in the proposed undertaking. It is expected that Eustace J. Bird will be appointed engineer of the work in the event of the company securing a franchise. The company will make a proposition agreeing to pay a certain percentage of the net revenue, and they will ask that the corporation deed to them the streets leading to the terminal station. It is stated that stock will not be offered for public subscription.

Insulated Wire Trade.—Manufacturers of insulated wire state that within the past two or three weeks there has been a decided slackening in the number of orders received. Earlier in the spring orders were fairly plentiful, and inquiries were so numerous as to encourage the manufacturers to expect a considerable increase in business. For some reason orders have fallen off, but the manufacturers expect that later in the season they will vastly improve. The amount of building that is going on all over the country makes it seem probable that wire business will be good. Prices are still somewhat unsettled, owing largely to the uncertainty as to the cost of rubber and other raw materials.

Third Avenue to Try Storage Cars.—The Third Avenue Railroad Company has placed an order with the General Electric Company for motors and control equipment for thirty storage battery cars. It is understood that these cars are to be used on the old horse car lines that are operated by the company. The operation of storage battery cars is considered somewhat of an experiment, and the contract for motors is contingent upon the success of the cars.

Westinghouse Business Improvement.—The Westinghouse Electric & Manufacturing Company reports that the orders booked during May amounted to $4,250,000, this being the largest single month's business in the history of the company. This places the electric company in line with the other Westinghouse companies, all of which have been breaking records in the way of business since the first of the year. The first of the companies to show such a decided improvement was the Air Brake company, which in January did a business of $2,000,000. Since then it is said that the ratio of improvement has been steadily maintained, and that the company is now busier than it has ever been. In March the Union Switch & Signal Company made a high record for orders booked, and the orders for the first quarter of the year exceeded the amount taken during the entire year 1909. In the month of April the Westinghouse Machine Company secured contracts for steam turbines, gas engines, steam engines and gas producers representing $1,200,000, which made that month the record in the company's history. The May business of the electric company, it is said, affects all of the various departments of work, electric locomotives, railway motors, generators, converters and power transmission machinery all receiving their quota of orders.

Toxaway Company Suit Ended.—An agreement between E. H. Jennings, of Pittsburgh, and R. B. Arrington, representing the Southern Power Company and Duke interests, by which the former purchases the bonds held by the latter in the Toxaway Company of North Carolina, has been announced thus ending the suit brought by A. H. Burroughs, trustee, and R. B. Arrington, against the company. When the bonds are transferred Mr. Burroughs is to resign as trustee, and Mr. Jennings is to name a new trustee. It is said that this decision will eliminate the Duke interests entirely, the outlay for bonds amounting to $260,000, and the purpose of the Dukes to carry out extensive water-power developments will be rendered impossible. The Toxaway Company proper, was organized sometime ago for the development of extensive summer and winter resort hotels, and the creation of an immense preserve in connection with the hotel system. It is added that Mr. Jennings will proceed to develop a fine waterpower site in the property, where surveys have been made, and estimates completed indicating that there is 25,000 hp available in the water power in question.

Montreal Light, Heat & Power Company.—General Manager Norris of the Montreal Light, Heat & Power Company has sent a letter to the city authorities of Montreal stating that the company desires to be relieved from the services of lighting the streets. The company also gives notice that it will terminate the present arrangement on Oct. 31, and that it will rent its poles to the city should a municipal service be decided upon. This action on the part of the company is the outcome of a disagreement between it and the city in regard to terms for lighting. The report of the company for its fiscal year which ended April 30, 1910, shows an increase in net revenue of $156,951. During the year the underground electric conduit system was extended, approximately 7 miles of cable having been installed. It was also decided to increase the output of the Lachine Rapids plant by the installation of 5000-hp additional machinery. Both gas and electric lighting rates were reduced during the year, and on May 1 further reductions were made for the ensuing year.

Offer to Use City Subway.—The Brooklyn Union Elevated Railroad Company, the elevated subsidiary of the Brooklyn Rapid Transit, has made a proposition to the Public Service Commission for the use of two tracks in the new city subway through Delancey and Centre Streets, from the terminal of the Williamsburgh Bridge to the City Hall. The proposal contains two offers, one to pay a certain per cent on a fixed valuation of $4,000,000 for five years, and the other to pay rental, based on the actual car-miles operated. It is figured out that under neither proposition will the company pay to the city more than $240,000 in rentals for the five-year terms of the contract, while in the same period the city will be called upon to pay $1,750,000 in interest on the bonds issued for the construction of the subway. It is not considered likely, therefore, that either proposition will be accepted.

Long Island Tunnels Almost Ready.—Rapid progress in completing the electrification of the tunnel system of the Pennsylvania Railroad under the East River is being made. It is now believed that it will be possible to put the tunnels in operation early in August. One hundred and forty new steel cars for use in the tunnel service are being received in weekly installments, and the Long Island Railroad Company last week placed an order for 100 more cars of the same pattern. Each of these cars complete costs $18,500. They will be equipped with Westinghouse motors and control. The first line opened will be that between the Pennsylvania terminal in Manhattan and Jamaica. As rapidly as possible electric service will be extended to Long Beach, Rockaway Beach and Far Rockaway.

Substantial Gains in Utility Earnings.—April operating returns of public utility organizations were extremely satisfactory, according to figures obtained by *Financial America*, a Wall Street publication. This paper says that none of the companies which has submitted its reports to the public has suffered a decrease in its gross or net as compared with the corresponding period of the year previous. A compilation of ten traction, gas and electric companies, which regularly report to this paper, shows that the increase in gross for April was equal to 9.16 per cent; in operating expense to 5.81 per cent, and in net to 11.12 per cent. This is a trifle better ratio of increase than is shown for the 10 months which ended April 30.

Electrical Construction.—Among the items printed under Construction News in our present issue are announcements of proposed new plants or considerable new extensions of present plants at Philadelphia, Pa.; Cincinnati, Ohio; Stafford, Kan.; Farnham, Que., Can.; San Francisco, Cal.; Minneapolis, Minn.; Palmer, Mass.; Arapoho, Okla.; Gaffney, S. C.; Beaver Dam, Wis.; Sidney, Ohio; Tyndall, S. D.; Tipton, Mo.; Council Grove, Kan.; Mandan, N. D.; Greenfield, Mo.; Alleghany, Cal.; Wapello, Ia.; Gold Hill, Ore.; Beatrice, Neb.; Richmond, Ind. and College Park, Ga.

Equipment of Dock Plant.—F. C. Werk, New England Building, Cleveland, has been awarded the contract for a complete power plant for the New York, Pennsylvania & Ohio Dock Company which has arranged for the construction of docks at Randall, Ohio. The building will be 40 ft. x 115 ft., ground dimensions, with a stack 150 ft. high. It will be equipped with cross-compound condensing engines, direct-current generators, water-tube boilers and all accessories. The plant is to be completed by Sept. 15.

Capital Traction Company to Build Power House.—J. H. Hanna, chief engineer of the Capital Traction Company, of Washington, D. C., spent several days in New York last week investigating the large power plants of the metropolis. It is the expectation of the Capital Traction Company to build a new power plant in the near future or to materially enlarge its present station. The plans have not yet been drawn but the new station will probably be of about 5000 kw capacity.

Development of Winnipeg Street Railway.—The Canadian Northern Railway Company, which has recently concluded negotiations for $40,000,000 new capital in the London market, has made an announcement of the purposes for which the money will be expended. In this announcement it is stated that $1,000,000 will be spent upon the development of the Winnipeg Street Railway Company, which is a subsidiary of the Canadian Northern.

North Shore Electric Light & Power Company.—The Public Service Commission of the Second District of New York has denied the application for a franchise of the North Shore Electric Light & Power Company, which sought permission to do business in the towns of Brookhaven and Smithtown, Suffolk County. There is already existing in that locality the Port Jefferson Electric Light Company, which concern promises to meet all the requirements of the territory.

Electric Controller Company.—The Electric Controller & Manufacturing Company, Cleveland, Ohio, has purchased 9 acres of land on Bessemer Avenue, near the Cleveland & Pittsburgh tracks, and early next year will begin the construction of a new factory for its own use. Detailed plans have not yet been made, but the factory will be modern in every way and one of the largest in the city.

New South American Cable.—The new cable line of the Western Telegraph Company of England, connecting Europe with Buenos Aires, Argentina, by way of Ascension Island, was opened June 3 for traffic. It is the second longest cable in the world.

To Try Gas-Electric Cars.—The Southern Railway has ordered several gas-electric cars for experimental service on short branch lines in South Carolina. These cars will be used for suburban traffic near several important cotton mill towns.

Financial.

The Week in Wall Street.

THERE has rarely been a week in recent years in the Wall Street market when conditions were more demoralized and prices were more uncertain. The bears practically had the market to themselves, and but for the fact that the bear clique was itself somewhat demoralized, the decline of prices would have been far greater. The action of the administration in bringing an injunction suit at the last moment, to prevent the increase in freight rates agreed upon by the Western railroads, has practically demolished the basis upon which those who have been preaching an advance in securities had rested their arguments. While it is the general opinion of traders that this action is mainly political, this opinion arising largely from the fact that the administration took no action until the last day before the Interstate Commerce Commission would have declared the advanced rates operative, yet it is recognized that whether political or not the adverse effect upon the railroad properties will be the same. The railroad managers have increased wages in all parts of the country, have contracted for quantities of equipment and have laid out plans for betterments and extensions. All of these expansions were predicated upon an increase of freight rates. To have this increase denied at the last moment creates a condition which is bound to be very unsatisfactory to the holders of securities. During the past week large blocks of the more active railroad shares, and also of the higher class industrial shares, have been thrown on the market, and net losses have averaged from 4 to 8 per cent. On June 6 the condition was no better than it was the first day after the policy of the administration had been announced. Stocks are weak because holders are anxious to sell, and because buyers are few. In the meantime the money market is thoroughly satisfactory, and borrowers have no trouble in securing all the funds needed for legitimate transactions. The investment market, however, is weak, and bonds are scarcely selling at all. Many large corporations have withdrawn their issues from the market on this account. Quotations for money June 6 were: 2 @ 2¾ per cent; 90 days, 3¾ @ 4 per cent. The quotations in the table are those of the close June 6.

NEW YORK.

	May 27.	June 6.	Shares sold.		May 27.	June 6.	Shares sold.
All.-Ch.	9⅝*	8¼	900	Int.-Met., pfd.	54¾	48½	22,670
All.-Ch., pfd.	32½	32	800	Mackay Cos.	87¾	85	810
Amal. Cop.	69¾	64	312,220	Mackay C., p.	76*	76*	
Am. D. T.	20½*	20½*		Man. Elev.	136*	132	720
Am. Loc.	48¼	41	14,200	Met. St. Ry.	15*	15*	
Am. Loc., pfd.	107½*	106	300	N.Y.&N.J.Tel.	139¼*	139¼*	
Am. Tel. & C.	75*	75*		Steel, com.	82⅝	75⅞	1,087,400
Am. T. & T.	136¼	132	12,225	Steel, pfd.	118	114½	24,385
B. R. T.	81	76	59,240	W. U. T.	67½	62¼	1,700
Gen. Elec.	148¾	140	4,600	West'h., com.	64	59	8,500
Int.-Met.	20⅛	17½	20,470	West'h., pfd.	110*	111*	100

PHILADELPHIA.

	May 27.	June 6.		May 27.	June 6.
Am. Rys.	45*	44	Phila. Elec.	15	14½
Elec. Co. of A.	11⅝*	11⅝*	Phila. R. T.	18¼	17⅞
Elec. St. B'ty	60	56¾	Phila. Trac.	85	85
E. S. B'ty, pfd.	30*	30*	Union Trac.	47⅝	46½

CHICAGO.

	May 27.	June 6.		May 27.	June 6.
Chi. City Ry.	180*	180*	Chi. Tel. Co.	117	118
Chi. Rs., Ser. 1	77*	77*	Met. El., com.	19*	21¼
Chi. Rs., Ser. 2	18	18	Met. El., pfd.	56½*	62
Com. Edison	113	112½	Nat'l Carbon	110*	108*
Chi. Subways	2⅝	2½	Nat'l Car., pfd.	115*	119

BOSTON.

	May 27.	June 6.		May 27.	June 6.
Am. T. & T.	136⅜	132⅛	Mex. Tel.	6*	5
Cum. Tel.	146*	145*	Mex. Tel. pfd.	6¼*	6½*
Edison E., Ill.	250	248	N. E. Tel.	133½*	133½
Gen. Elec.	149¼	141	W. T. & T.	15¼*	15¼
Mass. E. Ry.	17½	16½	W. T. & T., pfd.	87*	86
Mass. E. Ry., pfd.	85*	81			

* Last price quoted.
Shares sold for week of May 31 to June 4.

Financial Notes.

Federal Light & Traction Company.—The organization and financing of the Federal Light & Traction Company is said to have been completed. The company was recently incorporated under the laws of New York with a capitalization of $2,500,000 6 per cent preferred and $4,500,000 common stock. There will be no bond issue. The company represents the amalgamation by a syndicate composed of Sanderson & Porter, Harrison Williams, J. B. Colgate & Company and certain officials in the National City Bank of New York of eleven public utility corporations in the West. The new company has required practically all of the stock and bonds of the subsidiary companies. The properties involved in the consolidation are: Gray's Harbor Railway & Light Company, Aberdeen, Wash.; Sheridan (Wyo.) Electric Light & Power Company; Rawlins (Wyo.) Electric Light & Fuel Company; Montrose (Colo.) Electric Light & Power Company; Hobart (Okla.) Light & Power Company; Albuquerque (N. M.) Electric Power Company; Albuquerque Gas, Electric Light & Power Company; Las Vegas (N. M.) Light & Power Company; Las Vegas Transit Company; Tucson (Ariz.) Gas, Electric Light & Power Company and Tucson Rapid Transit Company.

Chicago Traction Situation.—Judge Grosscup has issued a formal statement saying that if the Chicago Railways-Consolidated Traction situation is not cleared up by June 20 an umpire will be appointed and a reorganization effected, as in the Union Traction case. The recent attempt to consolidate the elevated roads has been temporarily checked, owing to the receivership proceedings against the Chicago Railways, although it was announced last week that the South Side Elevated, the Northwestern Elevated and the Oak Park Elevated which carries with it the Union Loop have given options on their property. The Metropolitan Elevated directors are still conferring, but may reach an agreement any day. The financial interests promoting this consolidation are practically identical with those backing the Chicago Railways. Henry A. Blair, chairman of the Chicago Railways board, and one of the reveivers at present in charge of the property, has been the moving spirit in the elevated consolidation plan.

United States Motor Company.—A special meet ng of the United States Motor Company will be held in Jersey City June 15 for the purpose of increasing the preferred stock of the company from $8,000,000 to $15,000,000, and the common stock from $8,000,000 to $15,000,000. There will be no opposition to the proposal for this increase on the part of the stockholders. The business of manufacturing automobiles has been developing so rapidly that additional capital is made necessary. When the company was formed in January to take over several prosperous automobile concerns, $16,000,000 was thought to be ample capital for all purposes.

Western Ohio Railway Company.—The Western Ohio Railroad Company has been incorporated to take over on a lease the property of the Western Ohio Railway Company. The new company will pay the interest on the present company's bonds and their prinicpal at maturity, the dividends on the present preferred stock and on the proposed issue of 7 per cent preferred stock into which second mortgage bonds are convertible. The charter of the new company also gives authority to construct a road between Toledo and Dayton.

Consolidated Gas, Electric Light & Power Company of Baltimore.—Official announcement has been made by the Consolidated Gas, Electric Light & Power Company of Baltimore that negotiations have been concluded for the sale by E. H. Rollins & Son, bankers, of $4,000,000 of three-year, 5 per cent gold notes secured by bonds of the company. This sale is subject to the approval of the Public Service Commission. The proceeds of these notes will be used to refund $3,584,500 6 per cent bonds.

Holmesburg, Tacony & Frankford Railway Sold.—At the sale by the West Philadelphia Title & Trust Company, trustee under the mortgage, of the Holmesburg, Tacony & Frankford Electric Railway property last week, George B. Atlee & Company, bankers, were the purchasers. The price paid was $375,000. Representatives of the bondholders' committee bid $300,000. These were the only bidders.

Hydraulic Power Company.—The Hydraulic Power Company, of Niagara Falls, has filed with the Secretary of State a certificate of increase of capital stock from $500,000 to $12,000,000. The stockholders signing the petition include: Arthur Schoelkopf, Jacob F. Schoelkopf, George W. Olmsted, George B. Mathews, Paul A. Schoelkopf, C. P. Hugo Schoelkopf and Hans Schmidt.

Geist Not Selling His Properties.—Charles H. Geist, of Philadelphia, has denied the report that he is disposing of his holdings in the Northern Indiana gas and electric properties in Michigan City, Valparaiso, Hammond, Whiting and East Chicago. On the contrary he says that he is endeavoring to increase his holdings in this territory.

Third Avenue Railroad Earnings.—While the hearings upon the reorganization plan of the Third Avenue Railroad Company are going on from day to day, with little evidence that any progress is being made, the property itself under the management of Receiver Whitridge is making excellent increases in its earnings. The income account for the six months ended March 31, 1910, which has just been made public, shows: An increase in operating revenue, $298,969; increase in total net income, $207,600, and the increase in net income after taxes, fixed charges and rentals were deducted, $192,607. The total amount expended upon all of the properties in the Third Avenue system during the receivership has been $4,593,804. In addition to this there are 100 pay-as-you-enter cars contracted for. These cars have been partly delivered, and $500,000 has been set aside for this expense. Edward A. Maher, general manager for the receiver, says that the satisfactory results shown are due directly to the improved type of cars.

Havana Electric Railway Company.—The report for the year 1909 of the Havana Electric Railway Company shows gross earnings of $2,106,761, and total net earnings of $1,237,598. The report states that during the year the amount of maintenance work done was more than twice as great as in the previous year. Passenger traffic showed a considerable increase, partly due to the increase in population, but mainly attributable to the improved car service. Manager F. Steinhart says that the increase in earnings is especially noteworthy, as three tropical hurricanes visited the island during the year, causing a severe shrinkage in traffic. The increase in net earnings for the year was 33.8 per cent. The annual meeting of the company was held in Jersey City last week, and the old directors were re-elected.

American Union Telephone Company.—As a result of the receivership proceedings instituted two weeks ago against the Continental Telephone & Telegraph Company, the American Union Telephone Company, a subsidiary concern, was last week placed in the hands of receivers by the United States Court at Trenton. Charles West, of Philadelphia, and Frank D. Houck, of Harrisburg, were named as receivers. The company operates lines in western and northern Pennsylvania and in central New York. In the application for receivers it was claimed that the Continental company had been manipulating the American Union to the advantage of the stockholders of the Continental, and that the company is unable to meet its obligations.

Interborough-Metropolitan Notes.—The Interborough-Metropolitan Company announces that arrangements have been concluded for the extension until June 1, 1911, at the same rate of interest, of the $2,500,000 6 per cent collateral trust notes due June 1, 1910.. These notes are a part of an $8,000,000 issue put out on May 27, 1907, for the purpose of providing the New York City Railway Company with funds to electrify various horse car lines and to make other improvements then contemplated.

Italian Representative.—A business man in Italy advises an American consular officer that he would like to represent in that country a large American manufacturer of incandescent electric lamps, both those with ordinary carbon filaments and those with metallic flaments. He also desires to represent a manufacturer of electrical medicinal, dental, and massage apparatus. It is stated the party in question has had twelve years' experience in these lines, and will furnish the best commercial references. Applications should be made to the United States Bureau of Manufacturers, referring to the file number which is 5041.

Massachusetts Commissioners' Report.—The twenty-fifth annual report of the Massachusetts Gas & Electric Light Commissioners for the year which ended June 30, 1909, was issued last week. It contained returns of 67 gas companies, 57 electric companies and 20 persons or manufacturing corporations engaged in making or selling gas or electricity for light or heat. The operations of the gas companies showed an increase during the year of 3.2 per cent in profits, while the electric companies showed 1½ per cent decrease in profits.

Cambridge Electric Light Company.—A petition has been presented to the Massachusetts Gas Commissioners by the Cambridge Electric Light Company for authority to issue 500 shares additional capital stock of a par value of $100, to be sold at not less than $200 per share. The proceeds are to be used to cancel floating indebtedness.

Philadelphia & Chester Railway Sold.—The property of the Philadelphia & Chester Railway Company was sold under foreclosure sale last week to Samuel I. Freeman & Company, bankers, for $350,000. The purchasers bought the property in the interest of the bondholders reorganization committee.

DIVIDENDS.

American Smelting & Refining Company, quarterly, preferred, 1¾ per cent, payable July 1; common 1 per cent, payable July 15.

Continental Passenger Railway Company, Philadelphia, semi-annual, 3 per cent, payable June 30.

Indianapolis Street Railway Company, semi-annual, 3 per cent, payable July 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable July 1.

International Nickel Company, extra 25 per cent on common, payable July 25.

Muskogee (Okla.) Gas & Electric Company, preferred, quarterly, 1¾ per cent, payable June 10.

Niagara Falls River Company, quarterly, 2 per cent, payable July 25.

Philadelphia Union Traction Company, quarterly, 1½ per cent, payable July 1.

Providence Telephone Company, quarterly, 1 per cent, payable July 1.

Safety Car Heating & Lighting Company, quarterly, 2 per cent, payable July 1.

Virginia Railway & Power Company, preferred, 1½ per cent, payable July 1.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Canton (Ohio) Electric Company:					
April, 1910	$23,663	$10,129	$13,534	$3,155	$10,379
April, 1909	18,728	9,291	9,437	2,819	6,618
International Railway Company:					
Quarter ended March 31, 1910	1,101,657	696,135	405,521	210,559	136,206
Quarter ended March 31, 1909	995,280	641,947	353,333	227,653	75,111
Kansas City Railway & Light Company:					
April, 1910	601,476	407,208	194,268	158,790	35,478
April, 1909	552,628	308,610	244,018	156,271	87,747
Mexican Light & Power Company:					
April, 1910	509,839	124,928	384,911	.....	.....
April, 1909	515,219	362,061	153,158	.....	.....
Montreal Light, Heat & Power Company:					
Year ended April 30, 1910	4,240,945	1,848,878	2,392,067	480,866	1,911,200
Year ended April 30, 1909	4,079,769	1,844,653	2,235,116	489,268	1,745,848
Porto Rico Railways Company:					
April, 1910	44,775	20,725	24,050	.....	.....
April, 1909	31,870	16,851	15,019	.....	.....
Rio de Janeiro Tramway, Light & Power Company:					
April, 1910	657,822	345,541	312,281	.....	.....
April, 1909	609,162	380,033	229,129	.....	.....
Rockford (Ill.) Electric Company:					
April, 1910	29,560	18,545	11,015	5,707	5,308
April, 1909	26,528	17,137	9,391	4,495	4,896
Sao Paulo Tramway, Light & Power Company:					
April, 1910	231,521	82,624	148,897	.....	.....
April, 1909	204,484	75,073	129,411	.....	.....
Syracuse Rapid Transit Company:					
Quarter ended March 31, 1910	358,854	239,074	119,780	778,802	23,890
Quarter ended March 31, 1909	327,936	225,619	102,317	74,720	9,318
Terre Haute, Indianapolis & Eastern Traction Company:					
Year ended March 31, 1910	5,451,176	3,019,553	2,431,623	1,876,692	554,931
Year ended March 31, 1909	5,078,685	2,803,679	2,275,006	1,830,977	444,029
Union Railway Company:					
Six months ended March 31, 1910	929,688	661,084	270,251	115,886	154,365
Six months ended March 31, 1909	924,191	718,249	206,183	86,567	119,616
West Jersey & Sea Shore Railway Company:					
April, 1910	435,214	403,560	31,654	.....	.....
April, 1909	438,314	348,660	89,654	.....	.....

General News

Construction News.

DOUGLAS, ARIZ.—The Heffern Mining & Development Company, which is operating mines and reduction works about 20 miles from Douglas, is planning to erect a hydroelectric plant to provide electricity for lamps and motors for its own use and for towns in this section.

DOUGLAS, ARIZ.—Phelps-Dodge & Company and other mining interests are considering the proposition of joining forces in the erection of a large electric power plant at Douglas. It is proposed to erect transmission lines from the plant to the Tigre and other mining districts. The plant will also furnish electricity to operate the proposed electric railway which is to extend from the Tigre district to the Town of Yzabel.

MONTICELLO, ARIZ.—The Black Range Reduction Company is reported to be contemplating the construction of a hydroelectric plant near Monticello to furnish electricity for operating its mill and mining machinery.

PHŒNIX, ARIZ.—Los Angeles and Eastern capitalists have organized a company with a capital stock of $2,000,000 to construct a large dam at Striped Canyon, near the confluence of Big Sandy and Santa Mario Creeks, where it is estimated that 3000 hp can be developed, which will be transmitted to the various mining camps in Mohave and Yuma Counties.

DARDANELLE, ARK.—We are informed that the Russellville Water & Light Company. has purchased the municipal electric light plant in Dardanelle for $10,000. The company has also been granted a 50-year franchise, providing for the same terms as its Russellville franchise. C. S. Bacon, of Pine Bluff, Ark., is vice-president of the Russellville Water & Light Company.

ROGERS, ARK.—A 50-year franchise has been granted to the Rogers-Bentonville-Decatur Interurban Railroad to construct a railway in Rogers, work on the construction of which will begin at an early date.

ALAMEDA, CAL.—The Electric Light Commission is considering the question of closing down the municipal electric plant during the day and securing a supply of electricity for the day service from the Great Western Power Company. It is said that the day service furnished by the plant is operated at a loss. If it is decided to make the change the night service furnished by the municipal plant will not be affected.

ALLEGHANY, CAL.—The Middle Yuba Hydro-Electric Company is planning to construct two large hydroelectric power plants above the power plant of the Plumbago mine, for which sites and rights of way for transmission lines have been secured. The Middle Yuba Hydro-Electric Company has made arrangements with the Bay Counties Power Company to furnish electricity to operate the mines, pending the building of its own plant.

ETNA, CAL.—W. H. Mullin has submitted a proposition to the Board of Town Trustees for lighting the streets of the town.

GLENDALE, CAL.—Plans are being made by the Sunset Telephone Company for improvements and extensions to its system which will involve an expenditure of more than $100,000.

LOS ANGELES, CAL.—The contract for electric fixtures to be installed in the Higgins Building has been awarded to the Forve-Pettebone Company, at $9,000.

PORTERSVILLE, CAL.—Application has been made to the City Council by F. W. Nofziger for a 50-year franchise to construct an electric railway in Portersville.

RED BLUFF, CAL.—James Millard has filed notice of appropriation of 25,000 miner's inches of water in Cottonwood Creek, at a point about 20 miles west of the Southern Pacific Railroad. The water is to be used for generating electricity and for irrigating and mining purposes. The water will be diverted by means of a dam 200 ft. high, forming a reservoir covering lands in Shasta and Tehama counties. Notice of appropriation of 11,000 miner's inches of water in South Battle Creek has been filed by W. W. Noble, which will be used in connection with the large system of electric power development on Battle Creek and its branches.

REDDING, CAL.—Notice of appropriation of 5000 in. of water on Hatchett Creek, 5000 in. on Roaring Creek and 5000 in. on Montgomery Creek has been filed by George O. Perry. The water locations are all located in the eastern part of Shasta County, and it is understood that all the water is to be concentrated at a power site on the Pitt River.

SACRAMENTO, CAL.—The County Supervisors have accepted the bid of Joseph Shaw for $50 for a franchise to erect transmission lines over the county roads for the transmission of electricity. It is said that Mr. Shaw represents the South Sacramento Power Company.

SAN DIEGO, CAL.—A petition has been presented to the City Council asking that it call an election to vote on the proposition to issue $1,500,000 in bonds, the proceeds to be used to establish municipal gas and electric light plants.

SAN FRANCISCO, CAL.—The United Railway Investment Company, which controls the United Railways of San Francisco, has filed an amendment to its charter increasing its capital stock from $50,000,000 to $56,000,000. G. W. Bacon, of New York, N. Y., is vice-president of the company.

SAN FRANCISCO, CAL.—Plans are being prepared by Hunt, Mirk & Company for a large power house for the South Side Light & Power Company to be erected south of Market Street. The offices of the company are in the Humboldt Bank Building. Mr. Cartwright has charge of the plans for the new building.

SAN FRANCISCO, CAL.—Bids will be received at the office of the constructing quartermaster, Fort Mason, Cal., until June 15 for installing a complete electric light system, including substation and fixtures at Presidio of San Francisco. Plans can be seen and blanks and information obtained on application. A deposit of $10 will be required to insure return of plans. Major George McK. Williamson is quartermaster.

SAN FRANCISCO, CAL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 12 for the construction, including plumbing, gas piping, heating apparatus and electric conduits, of the attendants' quarters, United States Marine Hospital, at San Francisco, Cal., in accordance with plans and specifications, copies of which may be obtained at the above-named office, or from the custodian at San Francisco, Cal. James Knox Taylor is supervising architect.

SAN MIGUEL, CAL.—The Board of Trustees has passed an ordinance granting a franchise to C. F. Hoffman to erect transmission lines through the public highways of the township of San Miguel for the transmission of electricity for lamps, heat and motors, also to lay gas mains.

BRIDGEPORT, CONN.—The Bridgeport & Danbury Electric Railway Company is reported to be making surveys for its proposed interurban railway to connect Bridgeport, Trumbull, Monroe, Newton, Bethell and Danbury, a distance of 20 miles. Morton F. Plant, of New London, Conn., is interested in the project.

PLAINFIELD, CONN.—The Natahawago Electric Lighting & Power Company has purchased a site for its proposed power plant. A power house 30 x 60 ft. will be erected. The company proposes to furnish electricity for lamps and motors in the villages of Plainfield, Griswold, Canterbury and Killingly, and has already secured contracts to furnish electricity for lighting the village of Lawton and Borough of Jewett City.

WINDSOR LOCKS, CONN.—Negotiations are reported to be under way between the Northern Connecticut Power Company and the Connecticut River Company, which will insure the construction of the new dam, near the southern end of King's Island, with a lock providing for navigation, free of tolls and maintained by the Government. It is estimated that the new dam will develop about 35,000 hp. The Connecticut River Company has agreed to turn over to the Northern Connecticut Company certain rights and all of its real estate north of the railroad bridge between Windsor Locks and Warehouse Point on both sides of the river, including King's Island.

CRESTED BUTTE, COL.—It is reported that the DuPont Company is contemplating the construction of a hydroelectric power plant and large ore reduction works in Crested Butte, Col.

CRISMAN, COL.—The Central Colorado Power Company has completed its transmission line to the substation of the Treasure Gold Mine, at Crisman, and is now furnishing electricity for operating the plant.

SWINK, COL.—The town is being wired generally for electrical service, which will be furnished by the Swink Electric Company, at 220 volts direct current. Electricity for operating the system will be furnished by the Swink plant of the American Beet Sugar Company.

WASHINGTON, D. C.—Sealed bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until June 24, for furnishing and installing lighting fixtures in the United States buildings in Chippewa Falls, Wis.; Danville, Ky.; Versailles, Ky.; Winchester, Va.; Jackson, Miss.; London, Ky.; Montgomery, Ala.; Gulfport, Miss., and New Orleans, La. (mint), in accordance with drawings and specifications, copies of which may be obtained at the above office. James Knox Taylor is supervising architect.

GRACEVILLE, FLA.—It is reported that the citizens have voted to issue $4,000 in bonds for the construction of an electric light plant.

PENSACOLA, FLA.—Bids will be received at the office of clerk of Board of County Commissioners, of Escanabia County, Pensacola, Fla., until June 23 for the installation of plumbing, heating, sewerage, drainage and electric conduit and wiring of the new jail building to be erected in Pensacola. James McGibbon is clerk of board.

ATLANTA, GA.—Application has been filed with the clerk of the superior court for a charter for the Coosa Creek Power & Mining

Company by J. R. Gordon and John D. Dickson, of Fulton County, and Z. W. Summerouer, of Union County. The capital stock is placed at $500,000, with permission to increase it to $1,000,000.

COLLEGE PARK, GA.—At an election held May 20 the citizens voted in favor of the proposition to issue $65,000 in bonds, the proceeds to be used for the installation of an electric light plant, water works and sewerage systems. A commission consisting of J. D. Hardin, W. J. Harrin and George B. Findley has been appointed to take charge of the improvements.

GRIFFIN, GA.—The Gresham Manufacturing Company, of Griffin, Ga., is reported to have secured the contract to erect a substation in Griffin for the Central of Georgia Power Company, of Macon, Ga.

BANCROFT, IDAHO.—Hyrum Call is reported to be interested in a project to establish a lighting plant in Bancroft.

CALDWELL, IDAHO.—We are informed that the Caldwell-Roswell Interurban Railway Company expects to commence work on construction of its proposed railway in July. The railway will connect Roswell, Caldwell, Notus, Greenfield and Big Bend, a distance of 27 miles. H. W. Dorman is president and general manager of the company.

CŒUR D'ALENE, IDAHO.—Preparations have been made by the Interstate Telephone Company for the erection of about four miles of new cable in this city at a cost of about $10,000. The company is also making extensions to its toll lines and exchanges in other towns.

CHICAGO, ILL.—The Chicago & Northwestern Railway Company is reported to be securing bids on a large list of tools, most of which will be motor driven.

CHICAGO, ILL.—Bids will be received by the Board of Trustees of the Sanitary District of Chicago, American Trust Building, Chicago, Ill., until June 15 as follows: Division A: The fabrication, erection and completion of the power house swing bridge over the lock canal of the Sanitary District of Chicago, near Lockport. Division B: For removal of tow-path bridge over the main channel of the Sanitary District of Chicago and the Desplaines River, where same enter the upper basin at Joliet, in accordance with plans, specifications and contract furnished by the Sanitary District of Chicago. Robt R. McCormick is president of Board of Trustees.

POLO, ILL.—The capital stock of the Polo Mutual Telephone Company has been increased from $10,000 to $40,000.

ROCK ISLAND, ILL.—Bids will be received by the City of Rock Island until July 4 for a fire alarm system. M. T. Rudgren is city clerk.

CRAWFORDSVILLE, IND.—The Board of Electric Light Commissioners has engaged J. W. Esterline, president of the Esterline Company, of Lafayette, Ind., as consulting engineer to design and supervise the construction of the new municipal electric light plant.

DECATUR, IND.—It is reported that the Fort Wayne & Springfield Railway Company is contemplating the construction of an extension to Portland, a distance of 18 miles.

HARTFORD CITY, IND.—The American Gas & Electric Company, of New York, N. Y., which owns the electric plant in this city and also Marion and Muncie, has purchased the plant and holdings of the Dunkirk Lighting Company, Dunkirk, Ind. The company has also been granted a franchise by the City Council of Red Key for a new lighting plant. It is understood that a large central power plant will be installed to furnish electricity for lighting all of the above-named cities.

INDIANAPOLIS, IND.—The Board of Public Works is making investigations relative to locating 250 new electric lamps in the city.

RAYS CROSSING, IND.—J. W. P. Meltzer & Company, of Rays Crossing, Ind., have announced that they will soon place orders for machinery for manufacturing electric supplies and lightning rods.

RICHMOND, IND.—Preparations are being made by the American Seeding Company for the installation of an electric light and power plant to furnish electricity for its works. The company now secures electrical service from the municipal plant.

SOUTH BEND, IND.—Preparations are being made by the Board of Water Works Trustees for rebuilding the water works system this year at a cost of $50,000. A new pumping station will be erected in Leeper Park, which will be operated by electricity.

DAVENPORT, IA.—At an election held May 24, the citizens voted to grant a 12-year extension of the franchise of the Tri-City Railway & Light Company, making it 25 years from date, in return for which the company agrees to build an electric interurban railway between Muscatine and Davenport, and to give the residents of Davenport 90-cent gas at the end of five years, a reduction of two cents to begin immediately and to continue until the end of five years. The present rate is $1 per 1000 cu. ft.

PAULLINA, IA.—Sealed proposals will be received until June 13 by David Algyer, town clerk, for the construction of an electric light and power plant in Paullina.

WAPELLO, IA.—The construction of an electric plant on the site of the old flour mill in Wapello is under consideration by the Utt Brothers Company, of Chicago, Ill. If the right of way can be secured, the company proposes to dredge out the old mill race and erect a power plant of sufficient size to supply electricity to the entire county. A committee consisting of H. O. Weaver, J. G. Keck and W. S. Isett, has been appointed to secure the right of way.

BURLINGAME, KAN.—The managers of the municipal electric light plant are contemplating establishing a day service.

COUNCIL GROVE, KAN.—Plans are being prepared by Burns & McDonnell, Kansas City, Mo., consulting engineers, for the construction of a municipal electric light plant in Council Grove.

STAFFORD, KAN.—Sealed bids will be received by G. A. Mikesell, city clerk, until June 27 for furnishing material and constructing an electric light plant and water-works system as follows: Section 1. Cast iron pipe, specials, etc. (2) Valves and hydrants. (3) Cast iron mains. (4) Erecting pumping station, receiving well, etc. (5) Furnishing foundations and material and erecting chimney. (6) Furnishing and erecting pumping engines on foundations furnished by the city. (7) For furnishing and erecting boilers and accessories, etc. (8) Furnishing and erecting generator, switchboard equipment, etc. (9) Furnishing material and erecting pole line, etc. Plans and specifications are on file at th office of the city clerk and at the office of the J. S. Worley Company, Reliance Building, Kansas City, Mo., consulting engineers.

COLLY, KY.—The Letcher County Home Telephone Company, it is reported, is planning to erect a telephone line from Sergent, via Vilas and Wright, to Bently, Ky., where connection will be made with the lines of the Elkhorn Valley Telephone Company.

PARIS, KY.—Arrangements have been completed for the consolidation of the Paris Electric Light Company and the Paris Gas Company, under which the last named company will take over the former. A. M. Dolph, of Cincinnati, Ohio, will be president of the consolidated company; S. M. Allen, superintendent of the Paris Electric Light Company will be succeeded by C. L. Steenbergen, present manager of the gas company. The company, it is said, will carry out the original plans for establishing a 24-hour service, for which preparations are now under way at the electric plant.

NEW ORLEANS, LA.—The Consumers' Electric Company is reported to have purchased a site on Tchoupitouslas Street, on which it proposes to erect a substation. Plans for the building were prepared by DeBuys, Churchill & Labouisse, of New Orleans. It is understood that bids are now being received for construction of same.

FORT HOWARD, MD.—Sealed proposals will be received at the office of the constructing quartermaster until July 5 for construction, plumbing, steam heating and electric wiring of a guard house and one quarters for four officers; also for construction, plumbing and wiring of fire station at this post.

FROSTBURG, MD.—The Maryland Coal & Iron Company, successor to Avery & Morgan, is contemplating increasing its capacity to 1000 tons daily. It is expected new machinery will be required, including a 150-hp boiler, 100-kw generator, 42-in. gage mine hauling motor, mining machines and rock drills.

SEVERNA PARK, MD.—Oscar L. Hatton, manager of the Severn Realty Company, 201 Gaither Estate Building, Baltimore, Md., is reported to have organized a company under the name of the Severna Park Water, Light & Power Company for the purpose of constructing an electric light plant and water works system. It is understood that contracts have been awarded for both plants and construction work is under way. Severna Park is not a post office.

BRANT ROCK, MASS.—Applications have been made to the Town of Brant Rock by Walter Peterson and B. Bryant for franchises to furnish electricity for lighting the streets and residences of the town.

CLINTON, MASS.—Governor Draper has signed the bill authorizing an appropriation of $125,000 for the purchase and installation of machinery to be installed at the Wachusett dam by the Metropolitan Water and Sewerage Board. The State Commission will receive proposals until June 15 for the purchase of power generated at the plant. Information pertaining to terms, etc., can be obtained at the office of the commission in Boston, Mass. It is understood that plans are nearly completed for the proposed plant.

LOWELL, MASS.—Work has commenced on the construction of No. 12 weaving mill for the Massachusetts Mills, 85x375 ft., five stories high. The mill will be equipped for electric motor drive throughout; two freight elevators will be installed. Contracts for machinery, sprinkling apparatus have not yet been placed. Lockwood, Greene & Company, of Boston, Mass., are engineers.

MARBLEHEAD, MASS.—The State Board of Gas and Electric Light Commissioners has authorized the consolidation of the Marblehead Gas Company and the Lynn Gas & Electric Company on the basis of eight shares of the Marblehead Gas Company for one of the Lynn Gas & Electric Company. The latter company is authorized to issue 25 shares of additional capital stock to make the exchange.

PALMER, MASS.—Preparations are being made by the Central Massachusetts Electric Company to increase the output of its plant. The company furnishes electricity for lamps in the villages of Palmer, Thorndike, Three Rivers, Bondsville, North Wilbraham, Monson, West Warren and Warren, and also for operating the electric railway system of the Springfield & Eastern Street Railway Company.

PITTSFIELD, MASS.—The committee on lights has voted to recommend that a five-year contract be made with the Pittsfield Electric Company for lighting the streets of the city.

DETROIT, MICH.—The Detroit Sulphite Pulp & Paper Company, of Detroit, Mich., it is reported, will install considerable electrical equipment, including alternating-current motors of the squirrel-cage type.

GRAND RAPIDS, MICH.—The Grand Rapids Cigar Box Company is reported to be preparing plans for an addition to its factory, 55 x 100 ft.,

four stories high, which, it is understood, will be equipped for electrical operation.

LANSING, MICH.—The Michigan Power Company is contemplating making improvements to its plant at the foot of East Ottawa Street, which will include the installation of an automatic weighing device on the furnace feeders of the six boilers, costing about $8,000.

CHISHOLM, MINN.—The question of installing a municipal electric lighting system in Chisholm is reported to be under consideration.

GRANITE FALLS, MINN.—It is reported that the city proposes to issue bonds for the construction of a dam and improvement of the water power recently purchased.

MINNEAPOLIS, MINN.—The St. Croix Falls Improvement Company has arranged with the Stone & Webster Engineering Corporation, of Boston, Mass., for increasing the output of the Taylors Falls power plant, which supplies energy to the City of Minneapolis, Minn. The present power house will be enlarged to provide room for two new 2500-kw generating units with exciters and step-up transformers, increasing the output of the plant to 15,000 hp. An additional transmission line 40 miles in length will be erected to Minneapolis, and transforming equipment will be installed in a substation in the outskirts of the city.

MINNEAPOLIS, MINN.—Application has been made to the City Council by the St. Paul, Rochester & Dubuque Traction Company for a franchise to run its cars to the center of the city.

SOUTH SAINT PAUL, MINN.—The South Saint Paul Electric Light, Heat & Power Company has been granted a 25-year franchise to furnish electricity for lamps in West Saint Paul. The company will commence work at once on the erection of a transmission line to West Saint Paul. E. W. Erick is general manager.

JACKSON, MISS.—Proposals will be received by J. R. Dobyns, superintendent of the Mississippi Institution for the Deaf at Jackson, Miss., until June 13 for construction of dormitory building, completion of main building, furnishing and installing electric motors and furnishing fire hose for the Mississippi Institution for Deaf at Jackson.

OXFORD, MISS.—The question of issuing $30,000 in bonds, the proceeds to be used for improvements and extensions to the municipal light and water plant, is under consideration. A special election will be held to submit the proposition to a vote.

FAYETTE, MO.—The Fayette Electric Light & Power Company has recently placed an order for additional equipment for its plant with the Allis-Chalmers Company, of Milwaukee, Wis. The order includes a 16 x 30 simple belted "Reliance" type heavy duty Corliss engine, which will drive a 150-kva, 2300-volt, 60-cycle, three-phase, 720 r.p.m. alternator, and a 6½-kw, 120-volt belted exciter.

GREENFIELD, MO.—The Greenfield Electric Company is contemplating the installation of an additional generating unit this fall. F. G. Van Osdell is secretary and manager.

KANSAS CITY, MO.—The Bell Telephone Company has awarded a contract to Messrs. Maple & Osage for the construction of a substation, to cost $20,000.

ST. LOUIS, MO.—The American Stove Company, of St. Louis, Mo., is reported to be planning to install a power plant to furnish electricity to operate its works. The equipment will include engine-driven, alternating-current units of from 400 to 450 kw.

TIPTON, MO.—It is reported that plans are being prepared by J. S. Worley Company, engineers, Reliance Building, Kansas City, Mo., for a municipal electric light plant, for which bonds to the amount of $17,500, were recently voted. Joseph Sommerhauser is city clerk.

BOZEMAN, MONT.—It is reported that plans are being considered by the business men in Bozeman for the construction of an electric railway from this place to Maudlow, a distance of 40 miles.

NORFOLK, NEB.—The construction of an electric interurban railway connecting Norfolk and Newman Grove is under consideration. W. R. Martin and associates are interested in the project.

BEATRICE, NEB.—At an election held May 31 the citizens voted to issue $70,000 in bonds, the proceeds to be used for improvements to the electric lighting plants and water works system. The W. K. Palmer Company, engineers, of Kansas City, Mo., have charge of the engineering work.

ANTRIM, N. H.—Announcement has been made by the Goodell Company, owner of the local electric plant, that if a new manufacturing establishment, which the Antrim Board of Trade will approve, can be secured for Antrim, the company will furnish electricity up to 50 hp free of charge until Sept. 1, 1911, and will furnish power thereafter for five years at a rate 10 per cent less than the average rate charged by any ten companies furnishing electrical power in New Hampshire.

BURLINGTON, N. J.—An ordinance has been introduced in the City Council to grant a 50-year franchise for an electric light plant to a company, which is said to be a subsidiary to the Public Service Corporation of New Jersey.

ALBANY, N. Y.—The Cayadutta Generating Company has applied to the Public Service Commission, Second District, for authority to issue $30,000 in capital stock and $20,000 in bonds; also for permission to construct and operate transmission lines for the distribution of electricity in the villages of Fonda and Fultonville and the Town of Mohawk, and to exercise franchises held by the company.

BROOKLYN, N. Y.—Orders have recently been placed by the Flatbush Gas Company with the Allis-Chalmers Company for new equipment for its plant, including a 2500-kva, 2400-volt, two-phase, 60-cycle, 1800 r.p.m. turbo-generator, which will be supplied with one of the new type "C" condensers.

BUFFALO, N. Y.—The Board of Supervisors has rejected all bids submitted for the power plant for the Erie County Penitentiary. New bids will be called for on revised plans, which are now being prepared. George C. Diehle, 575 Ellicott Square Building, Buffalo, N. Y., is county engineer.

BUFFALO, N. Y.—Bids will be received by the Department of Public Works, City and County Hall, Buffalo, N. Y., until June 16 for furnishing and installing two 3-conductor cables, to be composed of three separately insulated conductors, bound together and leaded, and one 3-pair telephone cable, each cable 7420 ft. in length, to extend from Portland Avenue pumping station to the new inlet pier of the Bureau of Water, Buffalo; also for excavating and building two tunnels with shafts under Erie Canal, one at or near Porter Avenue, the other at or near Jersey Street, in which to place the discharge pipes from the pumps in the Porter Avenue pumping station. Francis G. Ward is commissioner.

HUNTINGTON, N. Y.—The Huntington Light & Power Company has applied to the Public Service Commission, Second District, for permission to issue $150,000 in bonds and $23,700 of its unissued capital stock.

MASSENA, N. Y.—Arrangements are being made by the Aluminum Company of America for extension to its power house in Massena, providing for a development of 50,000 hp, which will involve an expenditure of about $750,000. It is understood that contracts for the work will be awarded in the near future.

PALMYRA, N. Y.—The Palmyra Gas & Electric Company has applied to the Public Service Commission, Second District, for permismission to extend its electric and gas systems under the franchises granted by the Town Board of Palmyra.

PORT JEFFERSON, N. Y.—The Public Service Commission, Second District, has denied the application of the North Shore Electric Light & Power Company, which asked for permission to furnish electrical service in the towns of Brookhaven and Smithtown, on the ground that territory is already supplied by the Port Jefferson Electric Light Company. The application of the new company was denied on condition that the Port Jefferson company shall make improvements to its plant and distributing system within six months. In case the Port Jefferson company fails to comply with the terms of the resolution, the application of the North Shore Electric Light & Power Company will be granted. The former company has filed an acceptance of the conditions imposed in its order with the commission.

ROCHESTER, N. Y.—The J. W. Gillis Company, of Rochester, N. Y., has awarded a contract to the Alexander, Shumway & Utz Company, of Rochester, N. Y., for the construction of a power house.

ENFIELD, N. C.—The Enfield Hosiery Mills Company is contemplating doubling the capacity of its mills. It is proposed to install some electrical power equipment.

FAYETTEVILLE, N. C.—At the second sale, held June 1, the properties of the Consolidated Railway & Power Company were purchased by J. Sprunt Newton and associates, of Fayetteville, for $65,500. The new owners, it is said, will make extensive improvements to the system.

SALISBURY, N. C.—The consolidation of the interests of the Salisbury Electric Railway and the company operating between Spencer and Salisbury has been effected under the name of the Salisbury-Spencer Electric Company. The company is capitalized at $400,000, and proposes to operate an interurban railway between the two towns and also a street car system in Concord, 25 miles distant. The officers of the new company are: W. F. Snyder, president and superintendent; T. W. Vanderford, vice-president, and T. J. Jerome, treasurer.

DEVILS LAKE, N. D.—The City Council is considering a proposition to install an ornamental system of street lighting, covering the entire business district.

FAIRMOUNT, N. D.—Bids will be received until June 14 by Charles R. Pinkney, secretary of the Fairmount Rural Telephone Company, for the construction of 14 miles of telephone line.

KENMARE, N. D.—It is reported that the plant of the Clark Cement Works, in Kenmare, N. D., which was destroyed by fire, will be rebuilt on a larger scale. It is understood that it will be equipped for electric motor drive.

MANDAN, N. D.—Extensive improvements are contemplated by the Northern Pacific Railroad Company in Mandan, including the installation of an electric light and power plant at a cost of about $60,000.

TURTLE LAKE, N. D.—The Washburn Telephone Company is contemplating extending its telephone line to Wiprud, a distance of eight miles.

ASHLAND, OHIO.—It is reported that the Ashland Gas & Electric Light Company is contemplating the construction of a new power station and the installation of new equipment.

CINCINNATI, OHIO.—Bids will be received at the office of Daniel Laurence, clerk of the Board of Directors of the University of Cincinnati, Room 6, McMicken Hall, University Buildings, Burnet Woods Park, Cincinnati, Ohio, until June 11 for furnishing materials and completing the power house on the University campus, Burnet Woods Park, and equipment of same, including concrete pipe tunnels, power piping and distribution, pipe covering, electric wiring and distribution,

smoke connection, coal cars, tracks, scales, etc., in accordance with plans, and specifications on file in the offices of Tietig & Lee, architects, Lyric Theater Building, Cincinnati; Garber & Woodward, architects, Andrews Building, Cincinnati; W. G. Franz, engineer, Union Savings Bank & Trust Company Building, Cincinnati, Ohio, and at the office of the clerk of the Board of Directors.

CLEVELAND, OHIO.—An ordinance will be introduced at the next meeting of the City Council authorizing an election for the purpose of submitting to the voters the proposition to issue $1,000,000 in bonds for the extension of the municipal electric lighting system. It is stated that neither the Collinwood or the Brooklyn plants are giving satisfactory service. It is proposed to improve the municipal electric system so that new territory can be taken in and to develop additional commercial service.

COLUMBUS, OHIO.—Business men of East Gay Street are considering plans for installing an ornamental street lighting system for that thoroughfare.

DAYTON, OHIO.—Specifications for the lighting of the new Wayne Avenue Market House will probably be modified to provide for an additional number of lighting outlets.

MARTINS FERRY, OHIO.—The Board of Control has awarded contracts for equipment for the municipal electric light plant as follows: For two boilers to the Erie City Boiler Company, of Erie, Pa.; engine to the Buckeye Engine Company, of Salem, Ohio, and for 250-kw generator to the Allis-Chalmers Company.

NEW PHILADELPHIA, OHIO.—The Tuscarawas County Electric Light & Power Company is reported to be contemplating the installation of a new 200-kw, alternating-current generator.

PORTSMOUTH, OHIO.—Fillmore Musser and P. E. Selby are reported to be interested in a project to develop the water power of Brush Creek to generate electricity for lamps and motors in Portsmouth, Ohio. It is understood that a company will be formed to carry out the project.

PORTSMOUTH, OHIO.—Arrangements are reported to have been completed by the Portsmouth Street Railway Company for the extension of its railway system to Hanging Rock, below Ironton, where it will connect with the lines of the Ohio Valley Electric Railway Company, of Huntington, W. Va. It is understood that work on the road will commence soon. R. D. York, of Portsmouth, Ohio, is general manager.

ROSSFORD, OHIO.—It is reported that the Edward Ford Plate Glass Works is considering the question of installing a 200-kw steam turbine unit in its power plant in Rossford, Ohio.

SIDNEY, OHIO.—The Sidney Electric Light & Power Company is reported to be contemplating the installation of additional equipment in its plant. It is said that the purchase of a steam turbine is under consideration.

SPRINGFIELD, OHIO.—It is reported that negotiations between the Springfield Light, Heat & Power Company and Theodore Stebbines, by which the latter was to take over the plant and holdings of the company on a lease and complete and extend the property, has been declared off, as some of the stockholders refused to agree to the terms of the lease. It is said that other propositions will be entertained by the company.

ARAPAHO, OKLA.—The O'Neil Engineering Company, of Dallas, Tex., is reported to be preparing plans for the installation of an electric light plant and water works system in Arapaho, to cost from $30,000 to $40,000. An election will be held to vote on a bond issue.

FORT SILL, OKLA.—Sealed proposals will be received at the office of the constructing quartermaster, Fort Sill, Okla., until June 17 for construction, plumbing, and wiring two field officers' quarters; one two-set officers' quarters and one four-set officers' quarters, at Fort Sill, Okla. Specifications, blue prints and information furnished on application to Captain David L. Stone, constructing quartermaster. A deposit of $5 will be required to insure return of plans and specifications.

MUSKOGEE, OKLA.—The capital stock of the Muskogee Gas & Electric Company has been increased from $1,500,000 to $4,000,000.

BURNS, ORE.—It is reported that a telephone company has been organized in Burns and proposes to install an exchange with underground cables, etc. Charles W. Ellis and others are interested in the project.

GOLD HILL, ORE.—Plans are being considered by the Gold Hill Railroad & Lumber Company for providing electricity for its new sawmill, now being constructed. The company will either erect a power plant in Gold Hill, on the Rogue River, or construct a transmission line from Butte Falls, where 20,000 hp may be developed.

BELLEFONTE, PA.—The Nittany Telephone Company has decided to extend its telephone system farther up Cedar Creek and to Fox Hollow, work on which will commence at once.

ELLSWORTH, PA.—The Ellsworth Collieries Company, it is reported, is contemplating the installation of additional electrical equipment.

HANOVER, PA.—Contracts have been awarded by the Hanover & McSherrystown Street Railway Company for grading the extension of its railway from McSherrystown to Conewago Chapel. The proposed railway will branch at Conewago Chapel, one line going to Gettysburg, and the other to New Oxford. Robert E. Manley, of Hanover, Pa., is general manager.

LEBANON, PA.—The East Hanonn Telephone Company, of Lebanon, Pa., has filed amendments to its charter increasing its capital stock from $10,000 to $25,000.

PHILADELPHIA, PA.—Bids will be received at the office of the commanding officer, Frankford Arsenal, Philadelphia, Pa., for 1300 tungsten lamps.

PHILADELPHIA, PA.—Daniel Killion, 211 North Third Street Philadelphia, Pa., is reported to be in the market for a No. 11 "A" Brush arc machine to supply 2000-cp 9.6 amp lamps, oil regulator preferred, or magnetic regulator.

PHILADELPHIA, PA.—Plans have been prepared by John T. Windrim for the erection of a large power house for the Philadelphia Electric Company, between Ranstead and Ludlow Streets, west of Twentieth Street.

PAWTUCKET, R. I.—The Pawtucket Electric Company has made arrangements with the Stone & Webster Engineering Corporation for the enlargement of the south power station in Pawtucket. The contract calls for the installation of an additional 5000-kw turbine and two 520-hp boilers; new coal-handling apparatus, including overhead bunkers, horizontal conveyor, coal crusher and elevator. All boilers will be equipped with mechanical stokers with forced draft apparatus. The present intake tunnel for condensing water will be completed, and a new discharge tunnel will be constructed for the entire plant.

PROVIDENCE, R. I.—Permission has been granted to the Narragansett Electric Lighting Company to erect a substation on Bough Street, Providence. The building will be 30 x 40 ft., two stories high.

BEAUFORT, S. C.—The property of the People's Telephone Company has been purchased by S. A. Agnew, of Brunson, S. C., and S. Reid Fitts, of Hampton, S. C., president and treasurer, respectively, of the Carolina Telephone Company, which operates the local line in Hampton County. It is stated that the company proposes to give a long-distance service if it can secure an extension of its franchise from the Town Council.

GAFFNEY, S. C.—Bids will be received by the Board of Public Works until June 15 for furnishing approximately nine miles of 6-in. to 12-in. cast iron pipe, fittings, hydrants, valves and boxes; erecting power station and filtration plant complete, including electrical machinery, heating plant, hydraulic connections, etc., according to plans and specifications, which can be obtained from J. N. Lipscomb, chairman, Board of Public Works. Plans can be seen at the office of William W. Lyon, the consulting engineer, No. 303 Duval Building, Jacksonville, Fla.

HONEA PATH, S. C.—The Chiquola Manufacturing Company is reported to have appropriated $10,000 as an inducement to the owners of the Anderson-Greenville electric railway to extend the road to this section. It is said that many more of the cotton mills will also offer financial aid to the company.

BLACK HAWK, S. D.—The Dakota Plaster Company, it is said, contemplates the installation of several large size alternating-current motors to operate the machinery in its plant.

MOBRIDGE, S. D.—L. E. Pierce has been granted a franchise by the Town Council to construct and operate an electric light plant in Mobridge.

TYNDALL, S. D.—Sealed bids will be received until June 15 at the office of H. B. Phœnix, city auditor, Tyndall, S. D., for construction of an electric light plant and improvements to water-works as follows: 1. Construction of brick building, 42 x 86 ft. 2. Gas-producer plant, consisting of two units, or crude oil engines. 3. Electric installation, consisting of two units. 4. Pole line and wiring. Also 25-hp motor; about 325 ft. of 8-in. sewer and a 50,000-gal. concrete reservoir. Plans and specifications are on file at the office of the H. B. Phœnix, city auditor, Tyndall, S. D., and at the office of Oscar Claussen, consulting engineer, St. Paul, Minn.

ELIZABETHTON, TENN.—It is reported that the Doe River Lighting & Power Company will change its name to Watauga Power Company. The company has recently awarded a contract to W. J. Oliver, of Knoxville, Tenn., for construction of a power plant on the Watauga River. The initial development calls for 3000 hp. It is reported that plans call for two more developments on Doe and Watauga Rivers of 6000 hp. J. H. Grayson is general manager.

McKENZIE, TENN.—At an election held recently the citizens voted in favor of the proposition to issue $18,000 in bonds, the proceeds to be used to erect a street lighting system and extensions to the water works system.

BROWNSVILLE, TEX.—The City Council has granted B. G. Stegmon a 25-year franchise to construct an electric street railway system in Brownsville, under the terms of which construction work must begin within four months, and it is obligatory that three miles be completed within one year.

CHAPIN, TEX.—A company is reported to have been organized for the purpose of constructing and operating an electric light and ice plant in Chapin.

COLEMAN, TEX.—At an election to be held June 11 the proposition to issue $20,000 in bonds, the proceeds to be used for the construction of an electric light plant, will be submitted to a vote.

CONWAY, TEX.—It is reported that an electric plant will be established in Conway, which will furnish electricity for lamps and motors in Conway, Panhandle and Claude. T. M. Wright, of Wicomico, Va., is said to be interested in the enterprise.

DALLAS, TEX.—We are informed that the Trinity Valley Traction Company, which proposes to construct an electric railway to connect Dallas, Waxahachie, Ennis, Corsicana and Palestine, a distance of 120 miles, expects to begin work on construction of its proposed railway next fall. The power stations will be located at Dallas and near Corsicana. The company is capitalized at $3,000,000. J. V. Watkins, 304 Scollard Building, Dallas, Tex., is president and general manager.

FORT WORTH, TEX.—The Fort Worth Board of Trade has under consideration a proposition to raise $300,000 to aid in financing the construction of an interurban electric railway between Fort Worth and Cleburne, Tex.

STAMFORD, TEX.—Whyman A. Barton, of Dallas, Tex., consulting and contracting engineers, are reported to be interested in a project to construct a street car system in Stamford.

WACO, TEX.—The City Commissioners are considering the question of calling an election to vote on the proposition to issue bonds, the proceeds to be used for the construction of a municipal electric light and power plant. The contract for street lighting with the Waco Gas Company does not expire for four years, but it is proposed to have the plant ready for operation at the expiration of the contract.

WEBSTER, TEX.—The central power plant of the Galveston-Houston Electric Company will be located at Webster. The building will be 70 ft. x 100 ft. and equipped with three 520-hp Babcock & Wilcox boilers, and one 1100-kw and one 500-kw steam turbines, with necessary condensers, water heaters, feed pumps, etc. Electricity will be generated at 2300 volts and stepped up to 33,000 volts for transmission to three substations, one of which will be located about eight miles south of the city limits of Houston, one near Dickinson and the third between Texas City junction and the causeway.

EPHRAIM, UTAH.—It is reported that the power house of the municipal electric lighting system was destroyed by fire May 31.

GUNNISON, UTAH.—The Gunnison Valley Power Company has awarded the contract for hydraulic and electrical equipment for its proposed hydroelectric power plant to the Allis-Chalmers Company, of Milwaukee, Wis., including a 540-hp turbine operating under 221 static head. Electricity will be generated at 2300 volts, which will be stepped up to 22,000 volts for transmission. Contract for wiring materials and fixtures was awarded to the Western Electric Company. The cost of the entire installation is estimated at $50,000. L. W. Roush, of Gunnison, Utah, is secretary and engineer.

OGDEN, UTAH.—The Ogden Rapid Transit Company has placed contracts for equipment for power house and railway system as follows: For one 500-kw motor generator set to the General Electric Company, of Schenectady, N. Y.; one 300-kw generator to the Allis-Chalmers Company, of Milwaukee, Wis.; for 210,000 lb. copper wire to John A. Roebling's Sons Company; for 25 miles of line material and rail bonds for seven miles of track to the Ohio Brass Company; 14 miles of rail bonds to the American Steel & Wire Company and for 1250 tons of rails to the Illinois Steel Company. J. W. Bailey, of Ogden, Utah, is superintendent.

LURAY, VA.—Proposals will be received by the Town Council until June 27, for lighting the streets of the town with electricity. Bidders are to submit prices on arc lamps of four and six amperes, and on 16 and 32-cp incandescent lamps, number of lamps to be determined by the Council, on a three-year contract, with privilege of extending it to five years, at option of Council. B. F. Batman is recorder.

RICHMOND, VA.—The Virginia Railway & Power Company is asking for franchises to extend its system on additional streets in Richmond.

BELLINGHAM, WASH.—The Whatcom County Railway & Light Company will issue capital stock to the amount of $400,000, the proceeds to be used for the construction of the new railway.

CASHMERE, WASH.—Bids will be received by the Town Council of Cashmere for the purchase of bonds issued by the town, of which the proceeds of $3,000 will be used for extension and improvement to the water and lighting systems.

COLVILLE, WASH.—The Kettle Falls & Columbia River Telephone & Electric Company has been granted a franchise to erect telephone lines over certain of the county roads.

MALDEN, WASH.—The Malden Supply & Power Company is reported to have purchased a site at the head of Rock Lake, where it is estimated that 2000 hp can be developed.

PORT ORCHARD, WASH.—The Bainbridge Development Company has applied to the County Commissioners for a franchise to construct an electric railway on Bainbridge Island, to connect with a ferry from Eagle Harbor to Seattle.

SEATTLE, WASH.—The W. W. Perry Company is reported to have secured the contract for the erection of a 250-ft. tower for the North American Wireless Corporation on the bluff at West Seattle, Wash. A power station, it is said, will be erected near Luna Park.

TWISP, WASH.—The West Side Telephone Company is reported to be contemplating extending its telephone lines into the Methow Valley.

VASHON, WASH.—Plans are being made by the Farmers' Mutual Independent Telephone Company for a number of extensions of its lines to different parts of the island.

CLARKSBURG, W. VA.—Contracts will soon be awarded by the Clarksburg & Weston Traction Company for construction of the first section of the Clarksburg & Weston electric railway as far as Mt. Clare. The proposed railway when completed will be 24 miles in length. James O. Watson, of Fairmont, is general manager.

FOLLANSBEE, W. VA.—Arrangements are being made by the Follansbee Brothers Company to increase the output of its steel mill, which will be equipped for electric motor drive. Orders have been placed with the Allis-Chalmers Company, of Milwaukee, Wis., for a 1500-kw, 2300-volt, three-phase, 25-cycle, 1500 r.p.m. turbo-generator set with an exciter coupled to an extension of the shaft. Steam for this unit will be supplied from the exhaust of the present engines.

HUNTINGTON, W. VA.—The Citizens' Light & Ice Company, it is stated, is planning to increase the output of its power plant and will install a 125-kw belted unit and other equipment.

MORGANTOWN, W. VA.—Contracts for the construction of the Dellslow extension of the Sabraton Railway Company will be awarded during this month. It is expected that work will soon commence on the extension of the Sabraton line to Fairmont. G. Gilmour Sturgis, of Morgantown, W. Va., is general manager.

BEAVER DAM, WIS.—The Beaver Dam Foundry Company is reported to be contemplating the erection of a new building, in Beaver Dam, which will be equipped for electrical operation. A steam-driven power plant will be installed, the equipment to include tubular boilers, engines, electric generator, switchboard, etc.

BERLIN, WIS.—The plant and holdings of the Berlin Lighting, Heating & Power Company are reported to have been sold to the Public Utilities Corporation. It is understood that no changes are to be made at present, but later the plant will be enlarged and improved.

GREEN BAY, WIS.—It is reported that equipment for a power plant for a new hospital building in Green Bay, Wis., will be required, including an electric generating unit, boilers, motors and other mechanical equipment. Plans were prepared by Foeller & Schober, of Green Bay, Wis.

KAUKAUNA, WIS.—The capital stock of the Kaukauna Telephone Company has been increased from $5,000 to $10,000.

KENOSHA, WIS.—Work has commenced on construction of a new power plant for the Thomas B. Jeffrey Company of Kenosha, Wis. It is understood that orders have been placed for the greater part of the equipment for the proposed plant.

MILWAUKEE, WIS.—It is reported that the new factory to be built by the Waltham Piano Company in Milwaukee will be equipped for electric motor drive. As yet it is not known whether electricity for operating the plant will be purchased or generated on the premises.

PULASKI, WIS.—The Pulaski Merchants' & Farmers' Telephone Company is contemplating the construction of telephone lines between Green Bay and Shawano and Flintville and Elm Grove.

CALGARY, ALTA., CAN.—The by-law to appropriate $70,000 for extension to the municipal electric light plant was carried by the ratepayers at an election held recently.

MEDICINE HAT, ALTA., CAN.—The city is contemplating the construction of a municipal electric light plant, to cost about $65,000. It is also considering moving the water works station to be operated in conjunction with the proposed municipal electric plant. A. K. Grimmer is city engineer.

VANCOUVER, B. C., CAN.—The power house of the British Columbia Electric Railway Company in Burnaby was recently wrecked by an explosion.

VANCOUVER, B. C., CAN.—Surveys are being made by the Esquimalt & Nanaimo Railway Company for an electric railway between Oyster River, on the east coast of Vancouver Island, to Campbell River, north of Comox Harbor. The proposed railway will be 12 miles in length.

WINNIPEG, MAN., CAN.—The Board of Control has passed a resolution opening negotiations for the sale of electricity to the City of St. Boniface. It is said that the City of St. Boniface favors the proposition to purchase power from the municipal plant, and if inducements are equal the city will get the contract. About 4000 hp. will be required.

BARRIE, ONT., CAN.—The Monarch Railway Company has applied for a franchise to construct a railway on certain streets in Barrie, connecting with Toronto. Work on construction of the proposed railway is to commence within two years.

BOWMANVILLE, ONT., CAN.—At an election held May 31 the by-law to purchase the electric plant of the Bowmanville Electric Light Company, to be owned and operated by the municipality, was carried.

NEW HAMBURG, ONT., CAN.—The ratepayers on May 30 voted in favor of the by-law to purchase the local electric light plant, to be operated by the municipality, for $8,000. The by-law to grant the People's Electric Railway Company a 25-year franchise on certain streets in the city was carried.

INGERSOLL, ONT., CAN.—At an election held May 26 the two by-laws, one to appropriate the sum of $39,800 to purchase the plant

of the Ingersoll Electric Power & Light Company, and the other to issue $15,000 for improvements and extensions to the plant, were carried.

FARNHAM, QUE., CAN.—The Town Council has decided to install an electric power plant at a cost of $100,000. It is said that the town will offer to furnish industrial companies which may locate in Farnham with power instead of a cash bonus.

GARVIN, SASK., CAN.—Bids will be received until July 15 by the Arm River Rural Telephone Company for the construction of a telephone line. W. Geier Switzer is secretary and treasurer.

GUANAJUATO, MEX.—The Guanajuato Power & Electric Company is erecting a high-tension transmission line from Leon to Jalpa, the hacienda of Oscar Braniff. The line will run near the Town of San Francisco del Rincon, where the company proposes to furnish electricity for lamps and motors.

GUADALAJARA, JALISCO, MEX.—The Chapala Hydro-Electric & Irrigation Company has resumed work on the construction of its transmission lines to the Hostopipaquillo, Etzatlan and other mining districts in the State of Jalisco. Announcement has been made that the company expects to be ready to furnish electricity in the above-named districts by Oct. 1.

IXMIQUILPAN, HIDALGO, MEX.—Preparations are being made by J. C. Azan and associates for the construction of a 5000-hp hydroelectric power plant on the Tonantonga River, located about 15 miles east of Ixmiquilpan. Surveys are now being made for the proposed plant and transmission lines, which will be erected for the transmission of electricity to the districts of Zimapan, Actopan and Ixmiquilpan.

PACHUCA, MEX.—The Compania de Luz, Fuerza y Ferrocarriles, which has acquired the old street railway in Pachuca, is contemplating extensive improvements and extension to the system. Theodore Brandenbury is general manager.

QUERETARO, MEX.—The Ajuchitlan Mining & Milling Company, which is operating mines near Ahorcado, Mex., is installing additional electrical equipment. Electricity for operating the mines is obtained from the Queretaro Power Company, of Queretaro.

TLAXCALA, MEX.—Announcement has been made that the Mexican (Vera Cruz) Railway Company, which has purchased the old tram line extending from Tlaxcala, Santa Ana, will rebuild the railway and provide new equipment.

New Industrial Companies.

THE ATLANTIC VACUUM CLEANER COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $50,000 by Albert M. Everett, William W. Graham, Joseph F. Autenreith, all of Jersey City, N. J. The company proposes to manufacture vacuum cleaners.

THE BOWER CONTRACTING COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 for the purpose of doing a general contracting business by Peter Sexton, 328 Third Avenue, New York, N. Y.; Joseph P. Ryan, of Pelham, N. Y., and Charles P. Bower, of Reading, Pa.

THE DUNKIRK CONSTRUCTION COMPANY, of Dunkirk, N. Y., has been incorporated with a capital stock of $20,000 by Charles D. Armstrong, Louis J. Fleishman, Peter F. Meister and Thomas Hefferman, of New York, N. Y. The company proposes to do a general contracting and constructing business.

THE EMPIRE CONSTRUCTION & FINANCE COMPANY has filed articles of incorporation under the laws of Delaware. The company is capitalized at $1,000,000 and the incorporators are: M. Parks, M. Strickler and R. Lemon, of Kansas City, Mo.

THE INTERNATIONAL COMPRESSED AIR MACHINE COMPANY, of Augusta, Maine, has been chartered with a capital stock of $1,000,000. The company proposes to manufacture engines and machinery. R. S. Buzzell is president, and H. M. Farrar, treasurer, both of Augusta, Maine.

THE OHIO ENGINEERING & CONTRACTING COMPANY, of Pomeroy, Ohio, has been incorporated with a capital stock of $5,000 by W. F. McCormick, E. G. Campbell, R. C. Cooper, H. E. Campbell and V. C. McCormick.

THE PALMER A. HART COMPANY, of Morrisville, N. Y., has been incorporated with a capital stock of $35,000 by Palmer A. Hart, of Morrisville, N. Y.; Max F. Huss, of Mt. Vernon, N. Y., and H. Keehn, of Paterson, N. J. The company proposes to do a general construction business.

THE ROGERS CONSTRUCTION COMPANY has filed articles of incorporation with a capital stock of $25,000. The incorporators are: G. O. Rogers, R. Booth and C. S. Carroll, of Pittsburgh, Pa.

THE TIEBERT GAS ENGINE COMPANY, of Butler, Ind., has been chartered with a capital stock of $20,000 for the purpose of manufacturing gas engines. The incorporators are: H. M. Showalter, D. A. Baker, J. W. Showalder, Frank Creager, E. B. Dunton, Walter Snider and J. G. Wagner.

THE UNIVERSAL ENGINEERING COMPANY has filed articles of incorporation with a capital stock of $100,000. The incorporators are: O. E. Williams, C. A. Conant and C. Schillinger, of Scranton, Pa.

THE WOODSIDE CONSTRUCTION COMPANY, of Woodside, N. Y., has been chartered by Louis Windmuller, William Heiman and Otto Loibl, of Woodside, N. Y. The company is capitalized at $30,000 and proposes to do a general contracting and building business and engineering work of all kinds.

New Incorporations.

MINERAL WELLS, TEX.—The Mineral Wells Electric Company has been chartered with a capital stock of $350,000 for the purpose of constructing an interurban electric railway between Fort Worth and Mineral Wells. The officers of the company are: S. B. Canty, of Fort Worth, Tex., president; Newton C. Blanchard, of Shreveport, La., vice-president, and W. C. Forbes, of Fort Worth, Tex., secretary.

CENTERVILLE, R. F. D., WAYNE, W. VA.—The Centerville Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The incorporators are: W. W. McComas, of White Creek, W. Va.; J. G. Lambert, D. B. Hardwick, of Wayne, W. Va., and others.

Personal.

MR. JOHN BOYER has been appointed superintendent of the Marion, Ohio, Railway & Light Company, to succeed Mr. Kade Neiswender, resigned.

MR. J. H. BOYDEN, of Washington, D. C., addressed the Toledo A. I. E. E. Section June 3 on the subject of automatic block signaling as applied to electric railways.

MR. J. W. PEDDICORD has been appointed by the Governor of the State of Maryland to serve on the Electrical Commission of that State. Mr. Peddicord succeeds Mr. Joseph M. Zamoiski.

MR. W. F. HAYNES, in charge of the Allis-Chalmers Spokane office, and who has been with the Bullock Electric Manufacturing Company and Allis-Chalmers Company, for the past seven years, has resigned.

MR. WILLIAM G. B. EULER, formerly of the San Francisco office of the General Electric Company, has joined the Great Western Power Company, to assume charge of its Big Bend hydroelectric generating station.

MR. JAMES N. BAKER has resigned as motor salesman attached to the office of the Westinghouse Electric & Manufacturing Company, at Louisville, to accept the position of electrical engineer with R. Hoe & Co., of New York.

MR. J. R. BALCOMB has moved his office from 184 La Salle Street to 1208 Title and Trust Building, Chicago. Mr. Balcomb is confining his work exclusively to hydraulic and hydroelectric enterprises, and has located and arranged his offices with this in view.

MR. ANDREW KIDD, JR., for many years connected with the General Electric Company in the capacity of engineer and representative, has severed his connections with this company and opened an office at 95 Liberty Street, New York, for the practice of consulting, electrical and mechanical engineering.

MR. WALTER M. McFARLAND, formerly vice-president of the Westinghouse Electric & Manufacturing Company, and at present associated with the Babcock & Wilcox Company, delivered an address to the graduating class of Stevens Institute of Technology, on May 31. The subject being: "The Utility of Engineering Education."

MR. W. F. WELLS, of the Edison Electric Illuminating Company of Brooklyn, has just returned from an extended trip in the West, whither he went for the purpose of inspecting the high-tension systems on the Pacific Coast. The trip consumed a month's time and included visits to power plants in Colorado, Utah, California, Arizona and Missouri.

PROF. SYDNEY WHITMORE ASHE has completed his lecture courses in Boston and in Baltimore and also the publication of his new volume on "Experimental Electricity," and is now spending the summer at South Harpswell, Maine, where he will remain with his family until Sept. 15. He has entirely recovered from his illness of the past winter and will be in condition in the fall to renew his lecture work.

Obituary.

MR. PATRICK J. BURKE, a pioneer in electrical railway construction, and a member of the Old-Time Telegraphers' Association, died at his home in Cheshire, Conn., on June 1, at the age of 64 years. He is survived by a widow and three children.

MR. CHARLES A. FLACK, president of the American Conduit Manufacturing Company, Pittsburgh, died on Monday, May 30, 1910, at his home in Parnassus, Pa., after a long illness. Mr. Flack had been closely associated with the American Conduit Manufacturing Company from the time of its inception, holding the office of president for the past seven years, although his illness extending over the past year forced him to withdraw from active business.

MAJOR PHILIP CARDEW, the well-known English electrical engineer, died in London, May 17 last, from the effects of a surgical operation. Major Cardew was born September 24, 1851, and was graduated from the Royal Military Academy in 1871. At different times he filled important positions in the government electrical service, and later took up consulting work. He was the author of many inventions, one of

which is the hot-wire instrument, generally known as the Cardew hot-wire voltmeter.

MR. WILLIAM BROADHEAD, an old and prominent resident of Jamestown, N. Y., died at his home in that city on May 21. Mr. Broadhead, who was a native of England, had reached the advanced age of 91 years, and had accumulated a fortune, mainly in textile industries. Through the Jamestown Street Railway Company, of which his son, Mr. A. N. Broadhead, is president, William Broadhead was largely interested in the Jamestown Lighting & Power Company, lately absorbed by the street railway company.

Trade Publications.

ENGINE TYPE ALTERNATORS.—Bulletin 24 of the Ridgway Dynamo & Engine Company describes the construction and sets forth the advantages of the company's engine-driven alternators.

BUFFERS.—Electrically driven buffing and gringing tools for jewelers, as well as small drill presses, are the subject-matter of a bulletin issued by the Holtzer-Cabot Electric Company, Brookline, Mass.

ELEVATOR MOTOR.—A direct-current motor, equipped with a specially designed thrust bearing is described in Bulletin 315 of the Holtzer Cabot Electric Company, Brookline, Mass. Data and prices are given in another publication.

HOUSE PUMPS.—A 12-page folder, issued by the Buffalo Steam Pump Company, Buffalo, N. Y., illustrates and gives dimensions and operating data on centrifugal, duplex and triplex pumps, built for motor, belt or steam drive.

POLYPHASE INDUCTION MOTOR.—A folder issued by the Kimble Electric Company, Chicago, Ill., describes and illustrates a polyphase induction motor built in sizes from 1 hp to 7.5 hp. Performance curves of a 1 hp. motor are shown.

MOTOR FANS.—The Sprague Electric Company, New York, has issued two fan booklets intended for distribution by dealers. One booklet is devoted to the company's line of direct-current fans and the other to its alternating-current fans.

ARC LAMPS.—The Western Electric Company has issued Bulletin No. 5500, which takes up the design and construction of multiple direct-current arc lamps. The bulletin is well illustrated with cuts, showing the details of the mechanism of the lamps.

ASBESTOS PACKING.—The third issue of the "J-M Packing Expert," published by the H. W. Johns-Manville Company, Cleveland, Ohio, is accompanied by a return post card, by which requests for samples and full information on various types of packing may be sent in.

AIR PRESSURE GOVERNORS.—The construction and operation of governors for maintaining pressure in an air brake system are described in great detail in Bulletin 390 of the National Brake & Electric Company, Milwaukee, Wis. Sectional drawings show clearly the construction and purpose of each part.

ELECTROTHERAPEUTIC APPLIANCES.—The Good Health Publishing Company, Battle Creek, Mich., has issued a 94-page catalog devoted to therapeutic appliances, a good share of which are electric, and include various applications of light and mechanical vibration used in treatment of different forms of disease.

COAL AND ASH HANDLING.—An illustrated description of different types of coal and ash-handling plants, including hoists, conveyors, storage bunkers, automatic scales, etc., is given in a booklet entitled "Economic Handling and Storage of Coal and Ashes," issued by the Guarantee Construction Company, New York City.

POLYPHASE INDUCTION MOTORS.—Bulletin 82 of the Wagner Electric Manufacturing Company, St. Louis, Mo., deals with two and three-phase induction motors. The general principles of operation are outlined and the relative merits of wound and squirrel cage motors discussed. The bulletin also describes auto starters and construction details of the motors.

ELECTRIC PLEASURE VEHICLES.—The Columbus Buggy Company, Columbus, Ohio, has issued a book entitled "Columbus Red Book." It is devoted to the advantages of the electric pleasure car and gives data and descriptions of different types of cars made by the company. The catalogue is accompanied by a booklet of testimonials from satisfied purchasers.

VEHICLE BATTERIES.—The Electric Storage Battery Company of Philadelphia has issued a booklet entitled "Undeveloped Central Station Business. $3,350,000 this year," which discusses in a convincing manner the possibilities of increased income to central stations from vehicle battery loads. A single 5-ton truck is equal to 144 flatirons in revenue-producing business.

AUTOMOBILE AND MOTOR BOAT ACCESSORIES.—A comprehensive line of electrical accessories for automobiles and motor boats is set forth in a very attractive catalog issued by the Pettingell-Andrews Company, Boston, Mass. It includes batteries, interrupters, induction coils, magnetos, timers, spark plugs, flash lamps, switches, magneto locks, electric horns and many other specialities.

POLE TRANSFORMERS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued a small bulletin (No. 4022) devoted to small transformers for lighting circuits. The construction is well illustrated and described in detail. These transformers are built to stand severe service, they are designed for high efficiency and to simplify regulation. Five and 10 per cent taps are provided to compensate for line drop.

TWIST DRILLS.—The Morse Twist Drill & Machine Company, New Pedford, Mass., has issued a new catalog giving data and prices for ordering drills, reamers, etc. It is the longest and most complete catalog yet issued by the company. With the catalog the company is also distributing a booklet, entitled "Young Machinists' Practical Guide," which gives tables and information of use in connection with drills and drilling.

INDUSTRIAL RAILWAYS.—Narrow-gage railways for industrial plants and temporary construction work, including track, switches, turntables, special work, etc., as well as types of cars for conveying various kinds of materials form the subject of Catalog 400 of the Arthur Kopel Company, New York City. The catalog is neatly printed on high finish paper, and the illustrations show well the construction and application of the apparatus.

STORAGE BATTERIES.—Bulletin 124 of the Electric Storage Battery Company, Philadelphia, Pa., gives information regarding the success of the adaptation of the Exide battery to emergency stations of very large power. The Exide battery occupies from one-quarter to one-half the space required by the Manchester plate for the same power. The Sixteenth Street substation of the New York Edison Company has operated a 150-cell Exide battery for over a year.

TELEPHONE LINE CONSTRUCTION—W. N. Matthews & Brother, St. Louis, Mo., have issued two useful little books on telephone line construction, one devoted to overhead work and the other to conduit construction. The construction of lines with the aid of Matthews' implements is described in detail, and many useful tables and specifications are given. The books are made in the loose-leaf style and are just the right size to carry in the hip pocket. They are listed at 50 cents each.

DIRECT-CURRENT WATT-HOUR METERS.—A commutator meter of the house type is the subject of Bulletin 8 of the Duncan Electric Manufacturing Company, Lafayette, Ind. The construction, installation, care and testing of the meter are explained in detail. The compensating device is adjusted with a tiny rheostat, by means of which the current through the compensating coil may be varied. The instructions include directions for reading the dials, a table of watt-hours per revolution for different sizes of meter test formulas, etc.

ELECTRIC CLOCKS.—Time indicating devices operated from a master clock are described and illustrated in Bulletin 108 of the Engineering Electric Manufacturing Company, Stamford, Conn. The master clock may be self or manual winding, and from it the time may be indicated electrically by secondary clocks. Also this master may be used to operate what is called a program system. The program system is a device for operating signals at predetermined times and can be used in schools, factories, and other places where signals are given at definite times.

FLEXIBLE SHAFTING.—Flexible mechanical transmission gearing opens a large field for small electric motor applications, and Bulletin 22 of the Coates Clipper Manufacturing Company, Worcester, Mass., illustrates a great many of these applications, and offers special tools and devices for use in connection with the Coates unit link flexible shaft and electric motors. One of the ingenious devices invented by Mr. Coates is a pair of gears so made and mounted as to permit a movement of the shafts through an angle of 135 deg. without interfering with the operation of the gears.

ANTI-FRICTION MATERIAL.—The New Era Manufacturing Company, Kalamazoo. Mich., has distributed a booklet which sets forth the character, advantages and uses of a material which is suitable for packing and bearings. It requires no oil at all, and is claimed to be extremely durable. It is a mixture of an anti-friction alloy, treated with lubricating oils and coated all over with a spongelike mass. The material may be had in a compressed form ready for work or it may be had in a semi-compressed form so as to be more easily adapted to special work, and then compressed when put into place.

BUSINESS NOTES.

THE MONITOR SALES DEPARTMENT, 106 South Gay St., Baltimore, has recently added 50 per cent to its floor space and shop force in order to keep up with orders. One of the recent additions to its line is variable-speed automatic control for high-speed rotary printing presses.

PITTSBURGH FEDERAL SIGN OFFICE.—The Federal Sign System (Electric), Chicago, has opened a branch office in Pittsburgh, Pa., at 3 Wood Street, under the management of Mr. L. F. Bruce, to provide for the demand for Federal electric signs, fixtures and specialties in that district. This is the fifteenth Federal branch office.

EDWARD SPRANLEY has opened an office and salesroom at 823 Perdido Street, New Orleans, La. He will have associated with him W. T. Spranley, formerly of Newman & Spranley, and L. B. Swift, previously with the Interstate Electric Company. The firm handles the products of out-of-town manufacturers of electrical supplies.

THE UNIVERSAL STANDARD ELECTRIC COMPANY, 90 Verona St., Brooklyn, N. Y., has succeeded to the Martin Electric Company of the same place. The same officers and directors who have been identified for years past with the Martin Electric Company will have charge of the management of the Universal Standard Electric Company.

THE WESTERN CARBON & STORAGE BATTERY COMPANY, of Seattle, Wash., is establishing a factory on First Avenue South, in Seattle, Wash., for the purpose of manufacturing dry batteries. James A. Gordon is president of the company; J. F. Gorman, formerly manager of the Pacific Carbon & Battery Company, San Francisco, Cal., will be manager.

THE PRECISION INSTRUMENT COMPANY has established headquarters at Detroit, Mich., for the manufacture and sale of instruments for measuring and recording pressures, temperatures, etc. The officers are: President, Mr. Andrew H. Green, Jr.; vice-president, Mr. V. F. Dewey; secretary and treasurer, Mr. Abram T. Baldwin; general manager, Mr. M. Woolsey Campau. The company will manufacture under license from the English corporation of Alexander Wright & Co., Ltd.

PARAGON SELLERS COMPANY.—The business of the Durant Electric Supplies Company and F. W. Pardee, Chicago, has been transferred to a new company organized on broad lines and equipped with adequate capital and facilities for handling a rapidly increasing business. The new company will be known as the Paragon Sellers Company, with officers as follows: President, Mr. E. M. Platt; vice-president, Mr. F. W. Pardee; secretary, Mr. E. E. Dewey; treasurer, Mr. R. E. Macduff. These officers are all actively interested in the conduct of the new company, the business address of which is 56 Fifth Ave., Chicago.

THE MONARCH ELECTRIC & WIRE COMPANY, of Chicago, manufacturer of insulated wires and cables, is erecting a new building at Adams and Desplaines streets in that city for its own occupancy. The structure, which will be ready for use about October 1, will cover an area of 100 ft. on Adams Street, by 100 ft. on Desplaines Street, with an addition having ground dimensions of 60 ft. x 20 ft. It will consist of six stories and basement, and, built of standard mill construction, will cost about $125,000. The entire space in the building will be devoted to the salesroom and offices, factory and warehouse of the company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 31, 1910.

[Conducted by W. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

959,462. CALL DISTRIBUTING SWITCH; P. V. Christensen, Copenhagen, Denmark. App. filed June 23, 1906. For multiple switchboard of telephone exchange in which a motor drives a plurality of contacts, a search magnet is in circuit with one contact and a series of speaking and signaling contacts are used with locking means operated by the search magnet to stop the travel of the member driven by the motor.

959,485. AUTOMATIC TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Jan. 8, 1909. Party line telephone system having a plurality of starting circuits provided with mechanism so that when one is disabled another automatically replaces it and whereby when the subscriber replaces his receiver all the selectors are released, the reconnecting of the line being prevented when the receiver has been removed.

959,486. ELECTRODE SUPPORT AND CONDUCTOR; I. R. Edmands, Niagara Falls, N. Y. App. filed Jan. 8, 1909. For depending electrodes in an electric furnace, suspended from a cable conductor which is counter balanced together with means for taking up the slack.

959,497. ELECTRICAL MEASURING INSTRUMENT; C. E. Foster Rochester, N. Y. App. filed Feb. 24, 1908. A thermal measuring instrument in which a bending member has greater flexibility than the thermal member and less electrical resistance.

959,498. TELEPHONE EXCHANGE SYSTEM; S. B. Fowler, La Fayette, Ind. App. filed May 27, 1907. The line and cutoff relays are combined in a unitary structure so that their armatures may control the line and supervisory signals.

959,510. RECEIVING APPARATUS FOR WIRELESS TELEGRAPHY; R. R. Goldthorp, Hartford, Conn. App. filed Oct. 29, 1909. A hollow tubular coil, a condenser located within the coil and a condenser regulator on the coil, together with a detector within the coil.

959,521. ELECTROLYTIC APPARATUS WITH LIQUID ANODE; K. Hahn, Winkel, Germany. App. filed May 27, 1909. An electrolytic apparatus with an anode compartment and a cathode compartment beneath it, a liquid anode covering the bottom, a solid cathode and a solid body above the bottom to prevent agitation of the anode.

959,525. ELECTRIC GAS-LIGHTING APPARATUS; D. M. Hartford, C. M. Taylor and L. S. Stone, Los Angeles, Cal. App. filed April 26, 1909. Jump spark igniter in which a plurality of gas burners are provided with valves and a plurality of sparking points ignite the flame, the circuits being controlled by a main switch and an auxiliary switch.

959,544. ELECTRIC APPARATUS; R. P. Jackson and H. M. Scheibe, Wilkinsburg, Pa. App. filed Jan. 21, 1909. For governing the starting and stopping of vapor rectifiers by means of a relay switch, an opening magnet, mechanism for holding the switch closed, and electrical means for locking the switch open.

959,548. ELECTRIC DRIVING DEVICE FOR REGISTERING MACHINES; C. F. Kettering, Dayton, Ohio. App. filed July 15, 1905. For cash registers, a driving electric motor, a circuit therefor, including a switch, a member driven by the motor connected to the switch by a spring and a projection on the member obstructing the switch.

959,550. VENTILATING MEANS FOR DYNAMO-ELECTRIC MACHINES; A. Kingsbury, Pittsburgh, Pa. App. filed July 9, 1906. A shaft with grooves in its circumference supporting a plurality of magnet disks with ventilating plates between the disks, two groups of slots near the surface of the structure, and circumferential slots interconnecting them.

959,551. ELECTRICAL MEASURING INSTRUMENT; S. M. Kintner, Pittsburgh, Pa. App. filed March 17, 1905. Electrostatic instrument for measurement of high voltage, in which a body of compressed fluid enclosed in a grounded receptacle actuates movable members.

959,552. FUSE FOR ELECTRICAL CIRCUITS; S. M. Kintner, Pittsburgh, Pa., and G. B. Rosenblatt, New York, N. Y. App. filed Nov. 4, 1905. A sealed insulating tube of breakable material, a fusible conductor suspended thereto and a receptacle filled with insulating fluid in which the tube is immersed.

959,569. MAGNETIC CLUTCH; F. R. Martin and O. M. Shepherd, London, England. App. filed Feb. 13, 1907. A wire equipped core with the wire coiled in separate and continuous sections and a leader wire connected thereto midway of the sections with means for demagnetizing one coil to release the clutch.

959,572. SWITCH FOR INCANDESCENT LAMPS; J. A. Mebane, South Boston, Va. App. filed March 21, 1908. The switch is operated by a key or by a push-button or by a cord.

959,594. ELECTRIC-LAMP SOCKET; J. G. Peterson, Hartford, Conn. App. filed Nov. 3, 1909. A shell with projecting tongues, a cap fitting the shell and a perforated split ring in the cap, the tongue entering openings in the ring when the shell and cap are put together.

959,609. ELECTRIC VALVE; F. N. Roehrich, Jersey City, N. J. App. filed July 30, 1909. Solenoid operated valve operating on a magnetizable device within the valve chamber with an electric device outside of the chamber to actuate it.

959,613. RELAY-SWITCH; H. M. Scheibe, Wilkinsburg, Pa. App. filed Jan. 21, 1909. For mercury vapor rectifiers in which a weighted lever tends to close the switch and the said member controls mechanism for holding the switch in an intermediate open position.

959,618. ELECTRIC VALVE; L. M. Schmidt, New Britain, Conn. App. filed May 6, 1909. Solenoid operated valve in which the valve of the chamber has a wall within the winding, and the valve is located within the chamber operated by a magnetizable core.

959,634. BRUSH OR COLLECTOR FOR ELECTRICAL MACHINES; S. Sparrow, St. Louis, Mo. App. filed Feb. 23, 1909. A collecting member having a cavity with a resilient member under compression in the cavity.

959,641. SWITCHBOARD FOR DENTAL, MEDICAL OR SURGICAL PURPOSES; D. Stern, Cincinnati, Ohio. App. filed July 6, 1909. Has electrical connections for a high-voltage circuit or for a low-voltage circuit.

959,645. MECHANICALLY CONTROLLED AUTOMATIC ELEVATOR; A. Sundh, Yonkers, N. Y. App. filed Oct. 2, 1907. Mechanical connections are provided between the cars and the floors and the controlling apparatus of the motor, thus doing away with extending electrical connections to the car and floor landings.

959,651. DYNAMO-ELECTRIC MACHINE; E. M. Tingley, Pittsburgh, Pa. App. filed Aug. 2, 1906. For ventilating cores, the holes being transverse to the axis, the shaft carrying scoops.

959,658. LIGHTNING ARRESTER; H. C. Walford, Berlin, Ontario, Canada. App. filed Nov. 23, 1908. A series of arresters are arranged on a rotating disk, driven step by step by an electromagnet on the passage of a lightning discharge.

959,718. RAIL-BOND; W. B. Cleveland, Cleveland, Ohio. App. filed May 2, 1908. And intermediate body portion, terminals affixed to the rail, carbon blocks secured to the terminal, and cementing clips securing the blocks in place.

959,719. FUSED TERMINAL; R. H. Conway and H. E. Bisbing, Philadelphia, Pa. App. filed May 12, 1909. A turning plug with a normal fuse connection and an auxiliary fuse connection, the latter in circuit when the former is being repaired.

959,730. PROCESS OF TREATING ELECTROLYTIC AND SIMILAR SOLUTIONS; G. A. Gabriel, New York, N. Y. App. filed May 31, 1907. Circulates the electrolyte for supplying pure electrolyte, concentrates the electrolyte to solid form, dissolves and introduces raw electrolyte.

959,765. TELEPHONE SYSTEM; A. D. T. Libby, Elyria, Ohio. App. filed Nov. 8, 1909. A plurality of telephone lines leading from substations to a central exchange, a three-strand cord at central for connecting two lines, switching means by which said central circuit is connected to the two lines, two of the strands connecting to a common contact of the switch to complete two independent circuits in the cord.

959,769. ELECTRIC SWITCH; W. D. R. MacDiarmid, Ottawa, Ontario Canada. App. filed June 3, 1908. Rotating commutator switch in which sparking is eliminated, the switch having a base, a central post, a casing with a central aperture, screw threaded on the inside and a pin on the post engaging the screw thread.

959,770. HEADLIGHT; R. R. Macdonald, Woodbury, N. J. App. filed June 13, 1908. Incandescent lamp headlight, the lamp having two or more filaments, with terminal sockets, so that if one filament is broken the current automatically passes through the other.

959,787. CIRCUIT CONTROLLING APPARATUS; L. C. Nicholson, Buffalo, N. Y. App. filed July 22, 1908. For polyphase lines which are connected at each end, a circuit breaker in each, a relay operating either one and controlled by currents corresponding to the sum of the currents of the phases of one of the lines.

959,788. CIRCUIT-CONTROLLING APPARATUS; L. C. Nicholson, Buffalo, N. Y. App. filed July 22, 1908. Two parallel polyphase lines, a circuit breaker in each, with means for producing two e.m.fs., dependent on the sum of the currents of the two lines, said e.m.fs. being applied to a circuit and means for selectively actuating the circuit breakers according to the phase of the current.

959,807. SAFETY-FUSE; J. Sachs and Frank D. Reynolds, Hartford, Conn. App. filed March 22, 1906. A tube, end caps therefor, fuse strip therein, and an indicator between the end cap and the tube for indicating the condition of the fuse.

959,818. LOCKING DEVICE FOR INCANDESCENT LAMPS; C. J. Timm and J. A. Barnhardt, Duluth, Minn. App. filed April 27, 1909. For preventing the stealing of lamp bulbs, the inner wall of the socket having a keeper and a spring catch encircling the base of the lamp with a hook to engage the keeper.

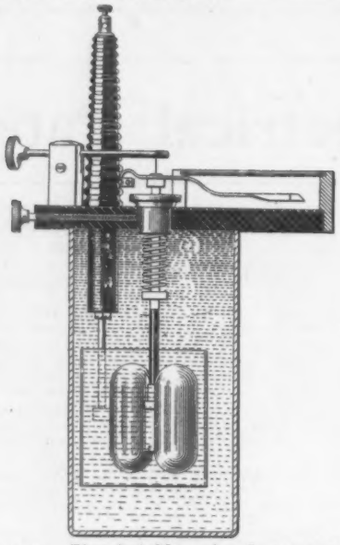
959,827. CIRCUIT-BREAKER; M. J. Wohl, New York, and H. Hertzberg, Brooklyn, N. Y. App. filed March 20, 1908. Thermal wires move a sector which is locked by the co-operation of a recess and spring-pressed projection.

959,872. ELECTRIC HEATER; J. F. McElroy, Albany, N. Y. App. filed June 25, 1907. A conduit enclosing a leading-in wire, a heater base, an electric heating resistance thereon with means for clamping a conduit to the base and a junction box covering the clamp, and connection between the lead and the resistance, which can be removed without disturbing the parts.

959,886. ELECTRICAL SWITCHBOARD; J. A. Schaefer, Chicago, Ill. App. filed July 15, 1907. Power switchboard in which the electrical apparatus is supported on the rear of the board and controlled from the front. Details.

959,887. SPEED AND CIRCUIT-CONTROLLING APPARATUS FOR ELECTRIC MOTORS; J. A. Schaefer, Chicago, Ill. App. filed Aug. 24, 1907. One switch operates the motor at different speeds, and the main switch throws it in and out of circuit. Details.

959,891. HANGER-BOARD SWITCH; H. L. Smith, Pittsfield, Mass.



959,551—Electrical Measuring Instrument.

App. filed Feb. 21, 1908. Rotary switch for electric lighting circuit having a rotary contact-carrying drum and escape wheel connected therewith, a pivoted member carrying a pallet co-operating with the wheel, a spring engaging the wheel, a wheel engaging with the other end of the spring, and a means to trip the pallet.

959,901. DYNAMO-ELECTRIC MACHINE; L. E. Underwood and Charles P. Smith, Lynn, Mass. App. filed Oct. 27, 1906. Motor-generator set with an annular perforated ring between the frames, a common shaft carrying the rotors and a combiner spacing and ventilating device on the shaft between the rotors.

959,907. MOTOR-CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed March 14, 1907. Rheostat and reversing switch having four rotatable contact arms, four stationary contacts, so that one arm passes over each set, a blow-out coil, the contact arms forming pole pieces for the coil.

959,908. MOTOR-CONTROLLING DEVICE; T. E. Barnum, Milwaukee, Wis. App. filed May 9, 1907. A plurality of circumferentially arranged contacts divided into sets, a pivoted lever sweeping over them and a plurality of continuous contact sections engaged by the lever.

959,909. CRANE-CONTROLLER; T. E. Barnum, Milwaukee, Wis. App. filed Aug. 27, 1907. Rheostat and reversing switch in which a plurality of circumferential contacts are mounted on the face plate and arranged in sets and electrically independent resistance units are connected therewith.

959,910. MULTIPLE-SWITCH STARTER; T. E. Barnum, Milwaukee, Wis. App. filed July 26, 1909. A bank of switches side by side on a base plate with latches for holding them closed, each switch being adapted when closed to retain the latch of a preceding switch in holding position.

959,913. ELECTRICALLY HEATED APPARATUS SUITABLE FOR COOKING AND OTHER PURPOSES; A. F. Berry, Ealing, Eng. App. filed Nov. 8, 1907. Electric heater with primary and secondary elements on the magnetic core and the heating portion having an inductive winding inserted with the secondary, a hot plate in inductive relation with the winding and composed of magnetic material.

959,919. ELECTRIC RAILWAY SYSTEM; F. E. Case, Schenectady, N. Y. App. filed Nov. 29, 1905. Two adjacent supply conductor sections energized by currents differing in character with an intermediate section between the supply sections and insulated therefrom and a switch connecting the intermediate section to either supply section.

959,929. HIGH-VOLTAGE SWITCH; W. T. Goddard, Victor, N. Y. App. filed June 12, 1908. A pair of supports connected by a section of insulator with a pair of terminals carried by the insulator, each having the arcing distance between it and its next support equal to the arcing distance between the two terminals.

959,954. ELECTRIC GENERATOR; J. L. Milton, Chicago, Ill. App. filed March 22, 1906. Induction alternator for ignition purposes in which the magnetic field has inturned polar projections and an unwound conductor moves within the field, the polar projections being radially adjustable.

959,958. INTERLOCKING CONTACT RELAY; W. M. McClintock, St. Paul, Minn. App. filed March 30, 1908. Mechanically interlocking contact relays for electrical crossing bells on single track railways consisting of rotating circuit closers, arms thereon, normally out of contact with each other, one arm moving with its circuit closers to limit the movement of the other arm and prevent the closing of the circuit.

959,959. DYNAMO-ELECTRIC MACHINE; J. E. Noeggerath, Schenectady, N. Y. App. filed June 30, 1906. Unipolar machine or rotary transformer with a plurality of armature conductors distributed around the core-collecting devices and cross-connectors for placing the conductors in series.

959,967. WAVE-RECEIVING DEVICE; F. G. Sargent, Westford, Mass. App. filed July 8, 1908. Wireless receiver or coherer having a zinc electrode and a carbon electrode.

959,977. ELECTRICAL CONNECTOR; F. L. Washburn and George E. Lawrence, Los Angeles, Cal. App. filed Jan. 13, 1910. Plug and lamp base making use of two spring-pressed contacts, one being a central terminal and the other a side terminal.

959,998. STOP-MOTION APPARATUS FOR HOISTS; A. M. Coyle, New York, N. Y. App. filed June 28, 1907. Hoisting device, motor and brake with means for automatically reducing the speed of the motor, operating the brake and accelerating the motor at a slower speed than it was reduced.

959,999. CURTAIN-HOISTING APPARATUS; A. M. Coyle, New York, N. Y. App. filed Oct. 14, 1907. For theater curtains, using two motors with power transmission means, including a hoisting drum and wheel, the wheel being disconnected from the driving member by an electromagnet.

960,000. METHOD OF AND MEANS FOR REVERSING MOTORS; A. S. Cubitt, Pittsfield, Mass. App. filed June 3, 1909. Four driving motors, normally operated in pairs, the motors of each pair being in parallel. The motors in the two or four motor equipment are reversed by reversing the field with reference to the armature and short-circuiting the field-coils during the reversal.

960,049. CIRCUIT-BREAKER; E. H. Smythe, Chicago, Ill. App. filed Oct. 21, 1904. A manual lever for closing the switch with a movable fulcrum controlled by electromagnetic tripping mechanism.

960,055. ELECTROMAGNETIC BRAKE APPARATUS; A. Sundh, Yonkers, N. Y. App. filed Oct. 2, 1907. A brake with a plurality of electromagnets of different capacities for releasing the brake, each operating independently of the other.

960,065. SUSPENSION MEANS FOR TROLLEY WIRES; S. S. Berkley, Ralphton, Pa. App. filed Aug. 27, 1909. For suspending and splicing the ends of trolley wire sections by means of a hanger carrying clamps, the splice uniting the sections between the clamps.

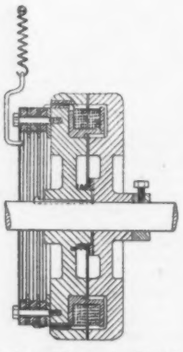
960,066. THIRD RAIL; C. A. Bluhm, Michigan City, Ind. App. filed March 3, 1909. A guard rail and twin rail chairs, the guard rails held therein and a conductor insulated from the chairs with fish-plates connecting the chairs.

960,087. BINDING-POST; G. W. Goodridge, Bridgeport, Conn. App. filed Dec. 17, 1908. Improved post doing away with wrapping the wire beneath the head of the binding screw by means of an upright standard having a lug bent to form a clamp.

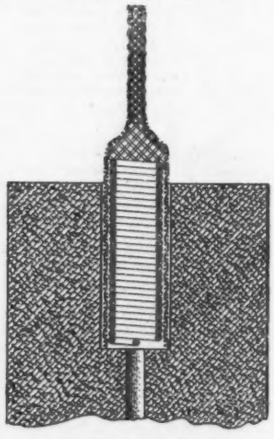
960,095. BRUSH-HOLDER FOR DYNAMO-ELECTRIC MACHINES; C. E. Johnson, Los Angeles, Cal. App. filed Feb. 23, 1909. Made by the punch press of sheet metal fastened to the support by a threaded stud and tube.

960,115. NEGATIVE PLATE FOR STORAGE BATTERIES AND PROCESS FOR THE MANUFACTURE THEREOF; P. G. Salom, Philadelphia, Pa. App. filed July 27, 1909. An initially formed plate for a storage battery in which the spongy lead particles are applied mechanically.

960,124. PUSH-BUTTON SWITCH; G. B. Thomas, Bridgeport, Conn.



959,569—Magnetic Clutch.



959,634—Brush or Collector for Electrical Machines.

App. filed Nov. 10, 1909. Push-button switch having a perforated rock lever with a spring pin engaging the perforation to detain the lever.

960,140. ELECTRIC DRIVING MECHANISM FOR VEHICLES; A. Aichele, Baden, Switzerland. App. filed Nov. 18, 1909. The wheel axle is connected to the motor by a flexible universal coupling so that irregularities of the wheel are not transmitted to the motor.

960,152. TROLLEY-POLE; C. E. Bradford, Lakeview, Wash. App. filed Aug. 24, 1909. Improved ball-bearing pivot for connecting the upper section carrying the trolley wheel with the main portion of the trolley pole.

960,155. FUSE-BLOCK; J. Collins, Washington, D. C. App. filed April 18, 1908. Three-wire fuse-block with four terminals on one side.

960,176. AUTOMATIC DISTRIBUTING SYSTEM; L. D. Kellogg, Chicago, Ill. App. filed June 15, 1907. For distributing the incoming calls, making use of a special operator's position, groups of telephone lines, each corresponding to one of the series, link circuits for each group, and switching means for each group to test the link circuits leading to the regular position and then those leading to the special position.

960,222. ELECTRIC-BATTERY CELL; M. E. Fuld, Baltimore, Md. App. filed March 12, 1906. Dry cell, with improved sealing device consisting of a metallic screw-threaded collar with an opening to receive a cell terminal.